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City of Norwich Water Works. No. 1.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

TO THE

HON. COURT OF COMMON COUNCIL,

ON THE

Inauguration, Construction, and Completion of the Water Works,

TOGETHER WITH THE

FIRST ANNUAL STATEMENT OF THEIR DOINGS.

CONNECTICUT.

NORWICH:
PRESS OF CAMPBELL & CO., 172 MAIN STREET.
1870.

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~~Norwich (Mass) Water Commrs~~

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CONNECTICUT.

NORWICH:
PRESS OF CAMPBELL & CO., 172 MAIN STREET
1870.

Office of the Board of Water Commissioners,
Norwich, Conn., May 1st, 1870.

To the Hon. Court of Common Council of the City of Norwich:

The Board of Water Commissioners respectfully submit this their Report on the Inauguration, Construction, and Completion of the Water Works, together with the first Annual Statement of their doings.

14 Oct '10 a.m.

REPORT.

In the autumn of 1868, the dam at the City Reservoir was fully completed, the waste gate finally closed, and the storage of water commenced. The results accomplished by months of labor and large sums of money expended, were about to come to a practical test. How few, then, among all the citizens, dared predict even moderate success for an experiment, a doubtful experiment as many believed, of gathering sufficient water in an open meadow, from a small stream, with only about three-fourths of a square mile of gathering ground, for an adequate supply of wholesome water, for the needs of ten or twelve thousand persons? The skeptical asked, "Can this little streamlet give us abundant, pure, soft and wholesome water?" Those who desire may now test its qualities, and witness a large and beautiful lake, clear and deep, lying high among the hills, with its arteries extended past almost every door, ready to supply the wants of the people, and powerful against devouring flames.

Men, thoughtful and sound in judgment, who had watched companies and individuals multiplying and interlacing their systems of small water pipes through the city streets, each radiating from its own independent spring, and none with a sufficient supply of water stored to meet emergencies, foresaw that all those sources combined would soon be unequal to the demands upon them by the steadily increasing wants of the citizens.

Experience had proved that the number of systems was not increased, as the demands upon them were multiplied; each passing summer's drouth gave evidence, that the combined resources were even then inadequate, and the theory of probability taught, that prospective wants would demand greatly increased supplies. Sound reasoning also taught, that this demand could best be met by a complete system of unquestionable capacity, furnishing unexceptionable water, and fully under the control of the city administration.

To the end that present requirements and prospective wants might be provided for, prudent men, frequently during the last decade, urged attention to the importance of the subject. Several public-spirited citizens had made inquiries and investigations on the subject from time to time, but the commissioners are not informed of any decided public action until the spring of 1866, when a respectable petition from citizens was presented to the Hon. Mayor, requesting him to call a city meeting to take action on the water question. The warmth with which he seconded the desire of the petitioners, and the hearty co-operation of his council, in the furtherance of their object, assured them that the project was to be propitiously inaugurated.

A meeting was called for this purpose on the 7th day of May, 1866, when there was a spirited discussion on the water question, and a vote was passed, with few dissenting voices, requesting the Mayor and Common Council, to petition the legislature for permission to issue bonds to the amount of one hundred thousand dollars, to constitute a water fund for the purpose of supplying the city with water. At the same meeting Messrs. Jedediah Spalding, Alba F. Smith and Gardner Greene, were appointed a Water Committee, to report at a future meeting.

The Common Council took measures to procure the passage of an act, in accordance with the vote of the city meeting, and an "Act to provide the City of Norwich with a supply of pure and wholesome water," was passed by the legislature, June 30th, 1866.

In the meantime the Water Committee were attending to their duties, and a city meeting was held on the 27th day of December, 1866, to hear their report, which was accepted unanimously, as follows:

REPORT OF THE COMMITTEE.

The Committee appointed at a City Meeting, held on the 7th day of May last, would offer the following report, as the result of their inquiries for the best source and plan, for supplying the City of Norwich with water. We have visited two ponds south and west of Bozrah Pond, Mountain Lake, (or Horse Pond), in the town of Salem, and Carr's Pond in the same town.

The elevation of both of these ponds, is sufficient to deliver their water by gravity. The water in Mountain Lake may not be wholly unexceptionable, but it is good and enough for our present needs. The water of Carr's Pond we judge to be without fault; the supply ample for any growth of the next fifty years; the elevation above the highest point in the city several hundred feet; the distance say two miles less than from Mountain Lake. Bozrah Pond is also hundreds of feet above our highest hill, the water faultless and several fold as much as that of Carr's Pond, say two miles nearer still. On the other side of the city, lies Preston City Pond. We have not visited this pond specially, but from some previous acquaintance with it and from inquiries we have made, we are of opinion that the bottom is somewhat muddy, and the water proportionately turbid: and the height though great enough to lift the water to any desirable point, not great enough to obviate the laying of very large pipes at largely increased cost. All of these sources of supply, we think particularly unavailable for the following reasons:

Speaking roundly, it would cost to lay a pipe of one foot bore, (the smallest we could recommend even at present) such as we could propose, say, twenty thousand dollars a mile. The waters of Preston Pond, Bozrah Pond, Carr's Pond, are all driving machinery; Preston at, say, seven different points, and several more points held for the same use. Bozrah, driving wheels in eight or more places; Carr's driving machinery we are told, but not how much. To pay for this mechanical force if we take any of these ponds, would require many thousands of dollars. From Preston Pond five miles of pipe, one hundred thousand dollars water rights to buy and get poor water. Bozrah Pond, eight miles, one hundred and sixty thousand dollars, and still more water rights to buy. Carr's Pond, ten miles, two hundred thousand dollars, and some water rights to buy.

But while we find these remote ponds, about some of which so much has been said, practically unavailable, there are close at hand, nay, almost within the city, two supplies which combined, would probably be ample for one hundred thousand people. First, the brook crossing the road near Dr. Gulliver's house, can be ponded on the land of Mr. A. F. Smith and others, and we think can thus be made to yield a supply of thirty gallons daily through the year, to ten thousand people.

This pond would be so near to the centre of the city, (say two and a half miles,) as at present to avoid the cost of a distributing reservoir.

The bottom of this pond, would be ten and a half (10½) feet below the highest point in the road or street passing over Jail Hill. A pipe of one foot bore brought from the pond, and reaching with its principal branches, all the important streets of the city, would supply water freely enough for fire, as well as other purposes. The other and larger supply, is given by Trading Cove Brook. The quality is excellent. The flow during low summer stages of the stream, enough, we think, to give forty thousand people each a barrel of water daily, and the valley through which the stream passes offers good facilities for storing the surplus water of the rainy season, and thus through the year, the present smallest flow could probably be four folded. This stream can be ponded at a point about two and one-half miles from Central Wharf, at a height that would carry the water freely through pipes of moderate size on to the Wharf, and from its level, it could be lifted by pumps to a distributing reservoir on some central elevation. We think $10,000 to $15,000 would buy and locate such a pump, and that for from $5,000 to $7,000 a year, water for forty thousand people, could be pumped into such a distributing reservoir, and that twice the quantity could be lifted for less than twice the cost. We think a reservoir of half an acre in extent fit to hold water ten feet deep, could be provided near the summit of Jail Hill, for from $12,000 to $15,000.

We propose as a plan the purchase at once of both sources of supply, and of a lot for a distributing reservoir, but the occupation now of only the first named source.

To do this the city will require power to issue its bonds for at least $150,000.

Norwich, December 27th, 1866.

JEDEDIAH SPALDING,
A. F. SMITH,
GARDNER GREENE, } *Committee.*

On the 29th day of December, 1866, the amendment to the City charter, authorizing the construction of water works, was accepted by vote in City meeting. On the 19th day of January, 1867, a City meeting authorized the Court of Common Council to issue bonds to the amount of one hundred thousand dollars.

On the 21st day of January, 1867, the Court of Common Council appointed, in compliance with the provisions of the charter, Messrs. Alba F. Smith, Jedediah Spalding, Gardner Greene and James S. Carew, and from their own number Mr. Nathan S. Gilbert, a Board of Water Commissioners, to act until their successors should be duly elected at a succeeding City election.

At the City election in June, 1867, Messrs. Alba F. Smith, Jedediah Spalding, James S. Carew and Henry L. Clark, were elected Water Commissioners, and Nathan S. Gilbert was re-appointed by the Council. Mr. J. T. Fanning was appointed Engineer and Secretary of the Board.

The amendment to the charter, provided substantially, That the Mayor, Aldermen, Common Councilmen and Freemen of the City of Norwich, were authorized and empowered, to take and convey from the Yantic River, or any other river, stream, pond or lake, such supply of water as the necessities or convenience of the inhabitants may require, with the consent of the parties having right thereto, or according to an appraisal provided for; to issue certificates of debt; to appoint water commissioners who should act until the next City election, and to maintain a board of water commissioners permanently, thereafter.

The amendment also provided, that the water commissioners should be empowered to make surveys, perfect plans and estimates, and make contracts for the execution of approved plans; to acquire the necessary rights, to maintain, protect, and extend the works, to fix a scale of water rates, and to prescribe the regulations for the supply of water.

This original water act was amended during the session of the Legislature of 1867, so as to provide for the further issue of bonds to the amount of Fifty Thousand Dollars, to give further powers to the Board of Water Commissioners, and authorizing the Court of Common Council to prescribe the duties of the President of the Board of Water Commissioners.

The first report of the Board of Water Commissioners, was presented to the Common Council on the 13th day of September, 1867, and was unanimously accepted and approved by the Council at the same meeting, as follows:

Report of Board of Water Commissioners.

Office of the Board of Water Commissioners,
Norwich, September 13th, 1867.

To the Honorable Court of Common Council of the City of Norwich:

Gentlemen: The Board of Water Commissioners, on whom is devolved the duty, of ascertaining a feasible plan for the introduction and proper distribution of an adequate supply of wholesome water into and through your City, for public and private uses, have examined the several sources of water supply in the vicinity, and have carefully compared their resources, the qualities of their waters, and the cost of introducing them into the City; and after duly considering their several merits, are agreed to recommend, that one of the tributaries of the Yantic River, having its source in the valley lying between the "Scotland Road" and the "Canterbury Turnpike," be adopted; and that the same, with the other waters in the vicinity of its source, be impounded about one mile easterly of the "Public Green" at Norwich Town, in a natural basin near the site where the "Collins Mill" was located some years since; and thus for the gathering and distributing reservoir, flowing a portion of "Fair View Farm" and adjoining lands of different proprietors, and that the water be brought from thence in a main conduit, and distributed by pipes throughout the City, at an estimated cost of one hundred and eighty-five thousand dollars.

In explanation and furtherance of their views, the board respectfully submit, for your consideration, the accompanying surveys, maps, and detail drawings, illustrating generally the manner in which they would recommend the construction of the works.

The map marked "Plan of the City Aqueduct Reservoir," shows the proposed location, form, and dimensions of the storing and distributing reservoir, which location now consists of meadows, pasturage, wood and mowing lands and have an extent of about sixty-eight acres, which it is proposed to "grub" and thoroughly clear of all vegetable and decaying substances, and to enclose with a suitable bank wall of rough masonry, against which the water will stand, when the reservoir is full, about three feet in depth.

It is also proposed, to procure such additional lands as shall be desirable, for the purpose of securing all or any of the water in the vicinity, that may be here impounded, and for depositing the excavated materials, procuring stone, and for the proper care and protection of the works. It is also proposed, to grade materials against the back of the bank wall in a proper manner to make a convenient passage around the reservoir, and to construct the required drains, culverts, subsidence pools for inflowing waters, fences and gates.

The required dam will be about thirty-three feet in height above the bed of the stream, and four hundred feet in length. The elevation of the reservoir overflow will be two hundred and fifty-three feet above the surface of the river Thames, at the City wharves at average low tide, two hundred and sixteen feet above the surface of Main Street, at the intersection with Union and Shetucket Streets, and nineteen feet above the highest point of "Kinney (Jail) Hill."

The storage capacity of the reservoir, will be about three hundred and thirty-three millions of gallons of water, a quantity, nearly twice that required for the present annual consumption of water in your city. The sources now proposed to be made available, allowing forty inches of water as the average annual rainfall in this locality, it is calculated will yield an average annual supply, of five hundred and twenty-five millions of gallons of water, fifty per cent. at least of which, is estimated as available, or a quantity equal to furnishing a constant supply of forty gallons per day to eighteen thousand persons.

In case the future growth of the city demands an increased supply, the above specified available quantity may be doubled by adding the waters of the adjacent valley on the westerly side. The elevation of this adjacent valley, and its other natural conditions affecting the result, are very favorable to conveying its accumulated waters into the proposed reservoir, or directly into the main conduit, at a moderate cost.

The map marked "Plan of City Water Pipe Lines" shows the location of the pipes for the distribution of water throughout the city, with the requisite appendages and connections, of gates, hydrants, waste valves, branches, cocks, and service pipes. The proposed pipe is to be cement-lined and coated wrought iron. The superiority of this kind of pipe, when carefully and skillfully made and laid, is now well established by an extensive and successful use of nearly twenty years, under all the various circumstances occurring in works similar to, and much larger than yours. In addition to the greatly increased cost of cast iron pipes, the rapid incrustation and consequent diminished service capacity, and discoloration of the water by oxides, are found in practice, to be serious objections to their use.

In the opinion of the Commissioners, the plan which they now recommend as the result of their investigations, presents in a favorable degree, advantages for the economical construction of permanent and complete works, in all respects ample and efficient.

All of which is respectfully submitted.

A. F. SMITH,
JEDEDIAH SPALDING,
JAMES S. CAREW,
HENRY L. CLARK,
NATHAN S. GILBERT,
Water Commissioners.

Three days after the acceptance of their first report, and approval of their plans, the Commissioners advertised for proposals for the furnishing and laying of the water pipes and their appendages.

Just before the first of October, 1867, nearly a year and a half after the initiation of the water project, and nearly a year after the presentation of the report of the water committee, a sharp, decided opposition appeared to have been suddenly stirred up. Soon the project was the absorbing topic in public places and by domestic firesides. Correspondents with various *noms de plume*, but none over his own name, condemned, in one of the city public prints, the project, and maligned the supporters of the project. Exciting circulars were distributed broadcast throughout the city, and opposition petitions were circulated.

Some correspondents proposed Bozrah pond as a source of supply, some Preston pond, some insisted that a dam should be built to show if there was, or was not, water to be had from the source selected, while another insisted upon delay, believing "delay might save trouble, and result in hitting upon some project which would commend itself to common sense and the public judgment." Others still, erroneously pronounced the works projected to be like those of another city, reported to have been a failure; and the opinion of one familiar with the site, "of reputed authority on questions similar to this, among manufacturers of a neighboring state," was quoted, who pronounced "the whole scheme of the commissioners as in the last degree impracticable and absurd."

As the excitement increased, a petition requesting a call for a meeting, "to take into consideration the propriety of rescinding the several votes of the city, authorizing the introduction of water at the expense of said city," was circulated, and received the signatures of upwards of three hundred persons. It is a significant fact, that about one-half of the signers of this petition are, at the date of writing, among the takers of water from the city supply, and the names of a large proportion of the remaining signers do not appear on the list of real estate owners in the city. In response to a petition, a city meeting was called and held on the 18th of October, 1867. At this meeting the President of the Board of Water Commissioners was called upon for explanations of the plans, and devoted an hour to explanations and answers to inquiries respecting the project.

A motion was then offered to the meeting, and passed, that a city meeting be called to vote upon the question, whether the citizens will or will not accept as an amendment to the city charter "An Act amending An Act to provide for a supply of pure and wholesome water in the City of Norwich, passed 1867."

After further discussion the following resolution was introduced:

Whereas, The Act entitled "An Act to provide for a supply of pure and wholesome water in the City of Norwich," authorizes and empowers the Mayor, Aldermen, Common Council and freemen of the city to issue notes, scrip or certificates of debt, to any amount not exceeding in the whole the sum of one hundred thousand dollars, for the purpose of taking and conveying from the Yantic river, or any other river, stream, pond or lake, such supply of water as the necessities or convenience of the inhabitants may require: and the inhabitants of the city accepted the said Act, as a part of the city charter, in the well founded belief that the expenditures authorized by its provisions could not, under any circumstances, exceed the amount of the notes, scrip and certificates of debt so authorized to be issued: and whereas the Board of Water Commissioners created by said Act have no authority, either with or without the consent of the Court of Common Council, to expend or contract to expend, a greater sum than may be raised by the sale or pledge of said notes, scrip and certificates, for the purpose of supplying the city with water, until the city, in legal meeting assembled, shall have accepted the Act of the last session of the General Assembly entitled "An Act amending an Act to provide for a supply of pure and wholesome water in the City of Norwich." Nevertheless, the Board of Water Commissioners have submitted to the Common Council a plan for the introduction and distribution of water into and through the city, the execution of which, according to their estimates, will involve an expenditure of one hundred and eighty-five thousand dollars, and have entered into a contract with the American Water and Gas Pipe Company, of Jersey City, for furnishing and laying pipes, putting in hydrants, waste valves, and cocks, at a cost of about ninety-seven thousand dollars: and the said plan and contract have been approved by the Court of Common Council: therefore,

Resolved, That the plan and contract be, and the same are hereby disapproved. And the Board of Water Commissioners, and Court of Common Council are hereby requested to abandon said plan, and rescind said contract without delay.

This resolution was debated with much spirit by several prominent citizens, when an indefinite postponement of the resolution was moved, and was carried by an overwhelming majority. The meeting was a very orderly one, and the discussion, which continued over three hours, was listened to with respectful attention by both sides, to the close.

The vote upon the acceptance of the amendment was taken on the 8th of November, 1866, with the following result, viz:

Whole number of votes cast	793
For water	443
Against water	350
Majority in favor of water	93

On the 9th of November, 1867, a city meeting was held in response to a petition circulated previous to the meeting of October 18th, at which the following vote was passed, with a single dissenting voice:

Voted, That the action of the Court of Common Council, and the Board of Water Commissioners, in regard to the introduction of pure water into the city, is hereby approved. And they are requested to complete the work in accordance with their plans, as soon as possible, consistent with economy and durability.

On the 1st day of November, 1867, the Court of Common Council authorized the Board of Water Commissioners to raise money by the sale of bonds to the amount of one hundred thousand dollars, in such installments as might be needed for the prosecution of the work.

All of these bonds were sold to the Norwich Savings Society, at par, with interest at six per cent.

On the 25th day of July, 1868, the Court of Common Council authorized the Commissioners to raise money by the sale of the additional fifty thousand dollars in bonds, provided for in the accepted amendment to the charter. These bonds were taken by the Chelsea Savings Bank, of Norwich, at their par value.

On the 28th of June, 1869, the Court of Common Council authorized the Commissioners to raise money by the sale of additional bonds to the amount of one hundred thousand dollars, which were disposed of at their par value.

The Rules, Regulations and Water Rates, adopted by the commissioners October 26th, 1868, are appended to this report.

On the 26th of May, 1869, the Board voted to employ Mr. H. B. Winship as superintendent and clerk, and the water-service and general care of the works were placed in his charge, under their direction.

At the June election in 1869, all of the original members of the Board remained in office, except Mr. Gilbert, who was no longer a member of the Council. P. St. M. Andrews, Esq., was chosen from, and appointed by the Court of Common Council, as Water Commissioner.

Detailed notes of the engineering works, and statements of the costs of construction, of pipes laid, and quantities of work performed; also, statements of cost of maintenance, and of water consumption, are herein presented.

ENGINEERING MEMORANDA.

Survey ordered.

The Board of Water Commissioners instructed their Engineer, on the 17th day of June, 1867, to make a survey of the water-shed of a brook at Norwich Town, running near Dr. Gulliver's house, above a point on the brook where then stood an old mill dam, near the southerly line of lands of Mr. A. F. Smith; to estimate the quantity of water that could be ponded therefrom; to stake out on the valley of the brook a suitable gathering reservoir; to measure the land which it would be necessary and desirable to purchase; also, to measure the length of pipe mains of the several diameters determined upon for supplying the populous parts of the city, and to estimate the number of public fire hydrants, stop-cocks, and air-valves, that would be required.

Site and area of Watershed.

The watershed designated lies along the summit of a section of the range of high land between the Scotland road and Canterbury turnpike, and the site of the reservoir is in the valley on the western slope of this range, which leads its waters down to the Yantic river. On the western slope of this range, and opposite the site of the reservoir, lies another valley leading its waters easterly to the Shetucket river. The two rivers are about four and one-half miles apart at the points where the two streams referred to enter into them, and at those points run nearly parallel to each other.

The principal streams of these two valleys near their sources lapped by, and at one point approached each other within five hundred feet. The site selected for the dam was about one mile below the point where the streams drew near together, and a dam thirty feet in height would just set the water over from the western to the eastern valley, at the point described. These peculiar features gave an excellent site for an overflow or waste-way discharging into the eastern valley, and a favorable opportunity to turn the head-waters of the eastern valley into the reservoir. A survey of the watershed of the principal valley, above the site of the dam, determined its area to be 393 acres, 3 roods and 3 rods, and of the eastern valley, above the point where the brook could be turned, to be

89 acres, 2 roods and 28 rods, making a total gathering ground of 483 acres, 1 rood and 31 rods. The site of the dam is about one and one-half miles from Williams Park, and two and one-half miles from the center of the city.

Estimate of Supply.

To determine accurately the average quantity of water that runs away, and that may be ponded from a given gathering ground for a series of years, it would be necessary to gauge and record the discharge of the stream frequently during the time, and deduce from the record the average flow; but as it was impossible to resort to this method for an immediate estimate, reference was made for an estimate to records of measurements previously made by others on locations with similar climate, and of similar physical features and formations. A collection of such data was gathered for this purpose. The annual mean of flow thus found, may as confidently be relied upon as is the annual average of births, longevities, mortalities and temperatures, in particular nations and climates, now so largely used as a basis for calculations in many financial and political speculations.

The calculations were necessarily dependent, first, on the amount of rainfall; for if there is no rainfall there can be, in this climate, neither surface water nor flow of springs, which last are but filtered portions of the rainfall; and second, on the discharge by the brooks, for when this has been determined and deducted from the rainfall, the remainder must be the sum of the quantities returned to the atmosphere by evaporation and resolved in the operations of nature.

The quantities of water discharged by the brooks are the quantities that may be ponded. From the quantity ponded due allowance must be made, according to the peculiar circumstances of the case in hand, for evaporation and absorption or leakage from the pond, to determine the available quantity. To judge understandingly of the discharge of water from a given watershed as compared with the rainfall on the same, its geological formation, climate, and the conditions of its vegetation, must be duly considered. In formations that have had the level of their stratas disturbed by volcanic action and having their stratas of different porosity, the water absorbed in the ground may be syphoned from one elevated valley to another lying lower. In the basin under consideration there appeared no reason to fear for the loss of water through underlaying strata, or that any considerable quantity would penetrate to a depth below the level of the base of the dam. About two-thirds of the surface of the gathering-ground is arable land and the remainder wood land, all with a considerable slope, and with a nearly impervious clayey strata lying near most of the surface, the whole being considered quite favorable for securing a larger per centage of the rainfall.

The estimate of rainfall on the water-shed under consideration, adopted in the calculations, was forty inches depth annually over the whole surface. The estimate of the per centage of this rainfall that could be ponded was sixty per cent. of the whole annual fall, the remainder being the estimated loss by absorption and evaporation. A deduction of ten per cent. was then made for evaporation and other losses, from the body of the lake. To save and make available this estimated per centage of water, a large storing reservoir was necessary, lest, during heavy rains large quantities should go to waste by overflow, and consequently during long drouths the supply be exhausted.

The calculations made on the adopted estimate of rainfall, and available per centage, provided ample storage was secured, were as follows:

Total annual rainfall, 525,066,334 (wine) gallons; total qantity annually available 262,533 167 (wine) gallons, which would be equal to a constant supply of forty gallons of water per day to eighteen thousand three hundred and twenty-four persons, or fifty gallons per day to fourteen thousand six hundred and sixty persons.

Extent of Reservoir.

Levels and cross sections of the lower part of the valley were taken to determine the extent and capacity of a reservoir adapted to the requirements of the case, and the flowage was staked out. The measurements of the flowage and a strip twenty feet in width, around the outside of the land flown, were as follows:

Captain C. B. Chappell	0	Acres,	0	Roods,	39	Rods.
Mr. A. F. Smith	28	"	0	"	29½	"
Captain Elisha Hull	20	"	2	"	16	"
Captain Joseph Hull	0	"	0	"	10	"
Mr. Henry Williams	0	"	3	"	33	"
Mr. William Staples	13	"	3	"	17	"
Mr. J. A. Yerrington	9	"	1	"	30	"

The Commissioners decided to purchase, also, eleven and three-fourths acres adjoining the flowage below the location of the old dam, on which the new dam would abut, and that would be required in the execution and proper care of the works, making in all a total of eighty-five acres, and fourteen and a half rods required. The right to widen out and work the old lane, from the Scotland road to the site of the reservoir, a distance of one hundred and fifteen rods, was also obtained.

Capacity of Reservoir.

The capacity of the reservoir to the level of the overflow, as staked out, is three hundred and thirty-three and one-half millions gallons, and the amount absorbed by the ground and given out again, as the reservoir is drawn down, increases the capacity to upwards of three hundred and fifty millions gallons. The length of the reservoir is one and one-eighth miles; the average width about four hundred and eighty feet; the average depth sixteen and one-half feet, and the surface sixty-six acres.

Estimate of pipe and appendages required.

The measurements of pipe required, of the several sizes determined upon, within the limits prescribed by the Commissioners, were as follows:

14 inch diameter, pipe	8,900	feet.
10 " " "	9,175	"
8 " " "	4,220	"
6 " " "	35,495	"
4 " " "	8,365	"

Making a total of sixty-six thousand one hundred and fifty-five feet, or about twelve and one-half miles.

The number of gates or stop cocks determined upon on these pipes, was forty-two; the number of air valves, ten, and the number of fire hydrants, after consultation with the Chief Engineer of the fire department, was sixty-eight.

Elevation of Reservoir.

The level of the overflow of the reservoir as staked out, is above the level of the following points, respectively:

Above the level of Williams Park	134	feet.
Above the level of the highest point of Jail Hill	19½	"
Above the level of Main st., at corner of Shetucket st.	216	"
Above the level of tide-water at the wharves	250	"

Maps and Estimates.

Maps were prepared of all the works, as laid out, and estimates were made of the costs of executing them, which maps and estimates were laid before the Honorable Court of Common Council, with the report of the Board of Water Commissioners, dated September 13th, 1867.

Specification of Pipes and Connections.

The report of the Board to the Honorable Court of Common Council having been accepted and their plans adopted, the specifications for the whole work and the detail drawings to fully illustrate the same were proceeded with, in which matter the President of the Board took especial interest. While these works were in progress the Board visited several neighboring cities, in which similar works had been executed, and examined critically the details of their construction, and afterwards held frequent meetings to discuss the merits of the numerous details of their own work.

Experimental Tests.

Experiments were made to test the strength and qualities of iron of the different gauges proposed to be used on the water mains, and to test different styles of rivetting for the larger pipes; the different methods and apparatus for lining wrought iron pipes with cement, and the different systems of jointing and laying; also, the connecting of service-pipes, and construction of branches, received especial attention.

Among the samples of fire-hydrants and stop-cocks examined, none were found wholly satisfactory, and the Commissioners found it desirable to have new drawings and specifications prepared of this most important part of the work.

Capacities of Pipes.

Careful calculations were made of the delivery capacities of the pipes, under their various pressures, and the system generally was proportioned to the requirements of a population of fifty thousand inhabitants, allowing a proper per centage for fires and accidental emergencies.

Proposals for Pipes.

In the month of September advertisements were inserted in the leading State and New York city papers, calling for proposals for furnishing, laying, and completing the water-pipes and connections called for by the specifications. Proposals were received from three parties, with satisfactory sureties. The proposal of the American Water and Gas Pipe Company, of Jersey City, being the lowest, was accepted by the Board. On the 28th day of September, 1867, a contract for the water-pipes and connections was executed with the American Water and Gas Pipe Company, of Jersey City, subject to the approval of the Honorable Court of Common Council; and the said Water Pipe Company presented bondsmen, satisfactory to the Commissioners, who became bound in the sum of forty thousand dollars for the faithful performance by the said American Water and Gas Pipe Company, of all the provisions of the said contract.

Provisions of Contract.

The contract provides that the said Company are bound to guarantee their work against all defects of materials and workmanship, for the term of three years after the completion and acceptance of the same. The contract was duly approved by the Honorable Court of Common Council on the 7th day of October, 1867, and was then in full force. A copy of the contract and the detailed specifications of the works of the water-pipe and connections are now on file with the City Clerk, where they may be referred to.

Specifications of Reservoir Work.

In the meantime, estimates had been made of the comparative proportions, and costs, of masonry and earth-work dams, and full detail drawings had been prepared of all the appurtenances belonging to the reservoir, to illustrate fully the specifications of the same.

In the latter part of October, advertisements were inserted in the leading State and New York city papers, calling for sealed proposals for executing the works of the embankment and reservoir.

Proposals, the amounts of which are shown in the appendix, were received from several parties, but, after a careful consideration of the same, the Commissioners declared, by a unanimous vote, that it would not be for the best interest of the City to accept any proposal then in hand.

President authorized to execute work.

Subsequently, by vote of the Board, the President was authorized to secure the necessary number of men, teams, tools, and materials, and to execute the works of the embankment and reservoir, according to the plans and specifications prepared. The Commissioners were confident they could execute the work at considerably less cost than would be necessary if a contract should be made in accordance with any proposal received. The wisdom of this decision is now fully apparent. Soon after this vote, Mr. Morey B. Cole, an experienced contractor and hydraulic constructor, was engaged as foreman on the reservoir works. The President and Mr. Spalding, of the Board, gave almost constant attention to the works of the reservoir, as they progressed.

Beginning to work.

A right-of-way, fifty feet wide, from the main thoroughfare to the reservoir having been secured and laid out, the superintendent, in December, 1867, gave his attention to the working on this of a convenient road-way to the reservoir. The early setting in of winter, and the heavy snows prevented the full completion of this work; but the way was made passable.

The line of the new road followed nearly the line of the old lane from the Scotland road to the mill formerly standing near the site of the present dam. During the winter, and early spring, the former owners of the reservoir lands cleared the wood from the lands conveyed to the Commissioners, they having retained the right to do so in their conveyances. The greater part of the brush on the low and wet lands of the reservoir was cut and burned during the winter, by laborers employed by the Commissioners. Excavations of soil and muck had been commenced at the extreme north end of the reservoir in the autumn, a few days before freezing weather commenced, but on account of the ground freezing, this work was soon suspended. Very little was accomplished until the frost left the ground in the spring, when the reservoir work was commenced in earnest.

Works of Reservoir Dam.

The works contemplated by the specification of the reservoir dam, and executed according to its provisions, are illustrated by the lithographic copies of drawings hereto appended. An earthwork embankment, or dam, twenty-five feet wide on the top, was constructed so as to form a drive-way, with a convex slope on the lake side, and with the outer slope one-and-one-half horizontal to one perpendicular. A puddled wall of clay and gravel, through the center of the dam, ten feet thick at the base and six feet thick at the surface of the water, was at first proposed, but in building, a grouted masonry priming, five feet thick at the base and two feet thick at the top, was substituted for the puddled wall of clay and gravel. The ground for the foundation of the dam was cleared of all soil, muck, stumps, roots and vegetable substances, and the work was built up of blue gravel in thin layers, sprinkled, and thoroughly settled.

A great deal of labor was bestowed on the trench for the priming or central wall. In some places it was cut ten feet below the original surface of the ground before a sufficiently impervious bottom was found. A portion of the line of the trench lay over a shaley rock, which was cut through and removed, it is believed, to the solid ledge. No pains were spared to make the dam a most thorough construction in every particular. The dam is thirty-five feet high, and four hundred and sixty-eight feet long on the top.

The waters of a small brook, entering the reservoir near the east end of the dam, were very serviceable for puddling the layers of the dam, and useful in preparing the cement mortar and grout. The elevation of the brook was sufficient to deliver its waters through hose to any part of the dam where required, without the aid of power.

The lake slope of the dam was rip-rapped, that is, covered with stones laid at right angles to the slope, closely fitted, and averaging not less than eighteen inches in thickness. The outer slope was covered with soil one foot thick and graded.

Well-House.

A masonry circular well-house was built up through the interior slope, to above the water line. That portion of the well-house to be under water is of rubble masonry, with a granite platform one foot thick placed on top, so its under side is at the level of the overflow. Above the platform is a granite curb of rectangular blocked quarry-faced masonry, containing the pipe adjusting machinery. The well-house is covered with a conical tinned wood roof, supporting a flag-staff. The well-house was finished with a clear diameter of eight feet on the inside, and there are projecting buttresses on its front, with an opening to the interior of the well-house between them from the floor to the water surface, through which an adjustible effluent pipe passes, and rises and falls. Grooves were cut in the face-angles of the buttresses for the reception of a gate by which the water may be shut out from the well-house. Into the coping of the curb has been placed a granite tablet bearing the following inscription :

1868.

Mayor :
L. BLACKSTONE.

Water Commissioners :
A. F. SMITH,
JED. SPALDING,
J. S. CAREW,
H. L. CLARK,
N. S. GILBERT.

Engineer :
J. T. FANNING.

The walls of the well-house were carefully grouted, so as to resist the pressure of the water when the gate may be closed in the buttresses, and the well-house emptied. The floor of the well-house is twenty-five feet below the level of the overflow.

Pipes in the Dam.

The pipes passing through the base of the dam are of cast iron, as follows :

One main waste-pipe, sixteen inches clear diameter, built into the foundation of the well-house, beneath the floor of the same; one eight inch branch-waste running from the interior of the well-house, at the level of the floor, for the purpose of emptying the well-house when the gate in the buttresses is closed; one sixteen inch main supply-pipe, with adjustable inlet, passing through the well-house, and one ten inch branch supply-pipe passing through the foundation of the well-house, with movable sections rising to near the surface of the water, for use when the adjustable pipe may require cleaning or repairs. All of these pipes are laid on masonry foundations, and pass through the gate-house where their gates, or valves, are located. These pipes were all of cast iron, from the furnace of Messrs. J. W. & J. F. Starr & Co., Camden, N. J. They were all submitted, at the furnace, to a bath of pitch and linseed oil at a temperature of 320 deg. Fah., and tested with an hydraulic pressure of 300 pounds to the square inch.

Adjustable Effluent Pipe.

A Y shaped pipe casting, forming the base of the effluent pipe, rests on the floor of the well-house, and to this is joined the main sixteen inch diameter supply-pipe. The arms of the Y casting are curved toward each other into heart-form, and are flanged at their ends. These arms are of fourteen inch diameter pipe. The adjustable pipe is of copper, sixteen inches in diameter. The foot of the adjustable pipe is made in ⊥ form, with the two arms flanged so as to make, when joined to the flanged arms of the Y casting a flexible joint, allowing the pipe to move freely in a vertical plane. The flexible joint has gun-metal flanges and rubbing surfaces. On the head of the adjustable pipe is a large perforated bulb, the sum of the perforations being double the sectional area of the pipe. The length of the adjustable pipe from the foot to the head is twenty-seven feet, so that when raised into a vertical position the bulb is accessible above water, from the platform on the top of the buttresses. In the curb of the well-house is set a shaft on which is fixed a hand-wheel and pulley. The adjustable pipe is counterweighted and retained in proper position by a copper wire weight-cord, attached to the pipe near the bulb and passing over and around the pulley, and connected to the counterweight suspended by it, in the interior of the well-house. A ratchet stop holds the shaft and pipe as adjusted. When the pipe is set in position the water enters the perforated bulb, passes through the copper pipe, and heart-shaped pipe, into the main supply-pipe. One man, with the aid of the adjusting machinery, can raise the bulb out of water for cleaning, or quickly set it in any desired position between the surface of the water and the bed of the lake.

This adjustable apparatus was suggested by, and constructed under the direction of Mr. Alba F. Smith, President of the Board, and has continued to work admirably to the present time.

Gate House.

A circular gate-house, with domed roof, was built of rubble masonry at the foot of the outer slope. This is eleven feet in diameter in the clear, inside, with a cast iron manhole and cover in the top of the dome, which is even with the surface of the ground. The adjustable apparatus and the gates were constructed by the Boston Machine Company, at South Boston, Mass.

A short distance below the gate-house a ten inch waste-pipe is connected to the main supply-pipe, and furnished with a gate.

Waste-Culvert.

All of the waste pipes discharge into a masonry waste culvert, three feet wide and five feet high, which conveys the waste-water away from the base of the dam, and empties it into the original bed of the brook.

Works of Reservoir Basin.

The works of the reservoir basin may be mentioned briefly, as follows:

The bed of the reservoir was thoroughly cleaned of brush, stumps, soils, roots and vegetable matters; a wall of rubble masonry was built entirely around the basin, a few feet within the flowage line; a passage-way around the basin was constructed adjoining the enclosing wall; a dam and canal were constructed, to divert the waters of the adjoining valley into the reservoir; culverts were built from several of the larger springs to lead their waters to the basin; other culverts were built beneath the road-way, around the basin, to lead in surface waters; a canal and overflow were built to conduct the surplus waters to the bed of the brook into which they are wasted, and such of the water courses and springs as needed attention were treated as the interests of the work seemed to require.

Time of Completion.

The Commissioners desired the work to be completed as early as the Autumn of 1868.

Help Required.

To accomplish this, sixty to eighty teams, and three hundred to four hundred men, were required from the opening of the spring-work, and the work required that accommodations for a portion of them should be provided on the grounds, where they would be under the control of the Superintendent. Arrangements were accordingly made to secure and maintain a boarding-house on the ground. Arrangements were also made with parties to provide the greater part of the horse-teams and ox-teams required, and to locate their stables on the grounds.

A blacksmith's shop was built by the Commissioners where there were facilities for doing not only the shoeing and iron work, but for making general repairs, such as are usually required on works of this magnitude. Repairs.

In the month of February, 1868, a contract was made for a patent stump-extractor, of sufficient strength, with animal power applied, to lift and transport ten tons. This was intended principally for extracting the smaller stumps, and was a four-wheeled carriage, with arched and trussed reach, fitted with a geared windlass, crank, pinion and power drum, in connection with the tackle and fall. Two sets of gearing were attached to the windlass and crank, one working with double the speed of the other, so that when a stump had been started with the slow motion it could be quickly removed from the hole by throwing the quicker motion into work. A lever machine was also built by the Commissioners, which, with the power of two yoke of oxen applied, was capable of taking out any stump on the grounds, and some of them were upwards of three feet in diameter at one foot above the ground. About 20,000 stumps, from four to thirty-six inches in diameter, were removed by these machines by the first of the following September. These stumps were burned on the grounds, and the ashes removed. Stump Extractors.

An unusually wet season during the spring, made the excavations in the meadow exceedingly heavy and tedious, as the frequent rains caused not only great loss of time, but kept the material so saturated, and the slopes so slippery, that but a small quantity could be taken out from the basin at each load. The excessive wet also made a great deal of extra drain-ditching necessary. The Commissioners estimated that the cost of the excavations during the months of April, May and June, in consequence of the unfavorable weather, was increased at least twenty-five per cent. Unfavorable Season.

During the excavations, a large quantity of stones and small boulders were exposed, which were in part worked into the bank-wall around the basin. In several locations, of almost an acre in extent each, the surface of the ground was literally covered with these stones, averaging, perhaps, one-and-a-half cubic feet each, so that only here and there a bush found its way out through them, and the masses had the appearance of having been at some remote period the bed of a rapid stream. Boulders

From some of the larger boulders, of thirty or forty tons weight, found in the valley, were broken the stones for the dressed and quarry-faced granite work of the well-house. The rights were secured with fees of the lands, to gather from the adjoining lands as many stones as might be required in the construction of the reservoir, and they were fortunately abundant. Upwards of forty thousand cubic yards of these stones and boulders were used.

Overflow. The position of the overflow is on the north-westerly side of the lake, about one mile from the dam, where its discharge is into a brook leading to the Shetucket river. Although the general slopes of the watershed are considerable, and many streams will, during heavy storms, pour their waters into the reservoir rapidly from all sides,—so rapidly that the flow over the old mill dam has reached a depth of two feet and over, on a roll-way twenty feet wide,—yet it is believed the water will not rise more than half this height on the new waste way as it has so large a surface in proportion to its gathering area to spread over, and each rise of an inch on the overflow must cause a corresponding rise over the whole surface of the lake. The discharge through the regular waste pipes in the dam will also aid in keeping down the water on the overflow. These influences will be beneficial in modifying the freshets in the brooks below the reservoir, as their excessive runs will be extended over more time and their discharges more even.

Grubbing. The entire bed of the lake was cleaned over. and all soils containing grasses or roots entirely removed. The thoroughness of this work may be judged by the fact that over three hundred thousand cart loads of materials were excavated and removed.

Bank Wall. The bank-wall, enclosing the reservoir, was finished three feet above the level of the overflow, from the dam up about half the length of the reservoir on each side, and the remainder two feet above the water surface. The bank-wall across the dam was carried up four feet above the water surface. These several levels were connected by gradual slopes of the top of the wall. The back-filling behind the bank-wall, excepting on the dam, has been mostly of soil removed from the reservoir. The bank-wall and its back-filling were not added to the plan with the view of constructing a public drive around the lake, but for the care and preservation of the purity of the water. Had this been intended for a drive-way suitable materials would have been used in the earthwork, and it would have been carried higher above the surface of the water, for the earth will be constantly saturated as high as, and a little above, the level of the water.

The depositing space behind the bank-wall was not sufficient to receive all of the materials excavated and removed from the bed of the reservoir, but large quantities were deposited on the adjoining lands, and in the valley below the dam. Due care was taken with the materials deposited along the sides of the reservoir to prevent surface water from penetrating them, or their being washed back into the lake.

The most important uses of the enclosing wall, and rip-rap at its base, are to prevent washings of the steep slopes when high winds dash the water upon them, to prevent the growth of aquatic plants, and to avoid shallow waters near the margin where the water might be raised in hot weather to a temperature sufficient to cause fermentation of any vegetable substance produced, or accidentally deposited there.

Culverts.

From the gutter on the outside of the road-way surrounding the basin, forty-seven culverts were built beneath the road-way to the reservoir. These culverts were two and one-half feet by one and one-half feet section, and two and one-half feet by three feet section, in the clear, according to their positions, as designated on the plans. Their sides were built of wall stones, their caps of large flat stones, and their bottoms were paved; and wing-walls projecting on each side were built on their upper ends. The four discharge culverts at the waste-way are three feet wide and five feet high, and from them leads a canal twenty feet wide and about one hundred feet long, to the overflow.

Payments.

Payments for all the reservoir work done by the day, were made monthly, ten days after the close of each month. A printed blank card, for each laborer, with his name written thereon, and showing the number of days he had labored, his price per day, and the amount due therefor, and a printed blank receipt for the amount, on the back of the same, for him to sign, were filled out each month from the records of time returned by the several foremen.

On the face of each ticket was endorsed all deductions charged to that ticket, and the balance due, shown.

A pay-envelope was prepared for each ticket, addressed, and endorsed with balance due, to correspond with its ticket. The tickets were then inspected and signed by the superintendent.

Each foreman's package of tickets was given to him two days before pay-day, and the tickets distributed by him among those entitled to them. The amount due each ticket was enclosed in its corresponding envelope. On pay-day, each foreman filed his gang past the engineer's office, on the works, in order, when each man received his pay-envelope in exchange for his receipted ticket.

The plan of payment being readily comprehended, and the foremen having instructed the men to have their tickets receipted before presentation, but little time was consumed in the payment of four hundred men.

These receipted tickets are now held on file as evidence of settlement with the men, and as vouchers for the amounts appropriated by the Common Council to pay-rolls.

Discipline.

The only case of insubordination which occurred during the progress of the construction, was a feeble and ineffectual attempt to strike for an increase of wages in the first part of the month of May, soon after the commencement of the work. This it is believed was chiefly instigated by influences from outside the works, and was so unpopular with the laborers that a simple decided refusal to accede to the demand for an increase at once disorganized it, and the majority soon applied for work on the old terms.

All of those who have been interested in the progress of these works may note, with gratitude, that their review is not saddened by the remembrance of a fatal accident, or removal by death, of any one engaged upon them during their progress.

Filling of Reservoir.

The reservoir gate was closed for filling the reservoir on the 23d of October, 1868, and the water began to overflow at the waste-way January 16th, 1870.

The time required for filling the reservoir, according to the estimated quantity that might be saved and ponded, as stated in the report dated September 13th, 1867, would be 474 days.

The time actually passed, between the closing of the gate and the commencement of overflow, was 450 days.

The estimated consumption of water during the time between the closing of the gate and the commencement of overflow, was 18,000,000 of gallons.

These calculations show that the actual quantity of water saved during the filling of the reservoir, exceeded the amount adopted as an estimated average by considerably more than the total consumption and waste during the same period, or an excess of ten and one-half per cent.; and show the daily average of water saved, while filling, to have been 817,778 gallons. This would be equal to a daily supply of forty gallons per day to 20,444 persons.

A record of rainfall kept in a neighboring district indicates an excess in the rainfall on our watershed, during the time of filling, nearly corresponding to the excess of water saved, thus verifying the original calculations.

Test of Pipes.

The test of the water mains commenced soon after the reservoir gate was closed. All of those pipes laid in the spring and early in the summer of 1868, whose cement linings and joints had sufficient time to become thoroughly seasoned, were found to be in good condition and fully able to bear the pressure of the high head of water, but a considerable number of joints required repacking on the pipes last laid.

Pressure on Pipes.

The pressure on the pipes, at the level of Franklin Square, when there is no draught on them, is ninety-five and one-half pounds, and at the level of the wharves, one hundred and eight pounds per square inch.

No indications of weakness of the iron of the pipes were discovered.

Iron of Pipes.

The thicknesses of iron used for the several sizes were as follows, respectively, according to the values of the Birmingham gauge:

14 inch diameter pipe	gauge No. 15.
10 " " "	" No. 17.
8 " " "	" No. 18.
6 " " "	" No. 19.
4 " " "	" No. 20.

The 14 inch diameter pipes were double riveted.

Acceptance of Pipes.

The water pipes were accepted by the Commissioners on the 4th of October, 1869, subject to a contract of guaranty providing for the maintenance of the whole of the pipe works against all defects of materials and workmanship, for the space of three years from the time of their acceptance.

Test of Hydrants.

The first public test of the fire hydrants was made on the 8th of January, 1869, under the direction of Chief Engineer Wm. M. Williams, of the Norwich fire department. During the test, hose were attached direct to the fire hydrants. Under a head of two hundred and twenty feet water was forced through two hundred feet of 2½ inch hose, with a 1½ inch nozzle, vertically to a height of one hundred and forty feet. The efficiency of the fire hydrants has already been tested at several fires with most satisfactory results.

The pressure in the water mains on Main Street is sufficient to force water through four hundred feet of hose, attached to the hydrant, and throw a stream of water entirely over an ordinary five story building.

Quality of the Water.

Although there were many persons, when the water project was first inaugurated, who had doubts respecting the reliability of the reservoir to furnish water in ample quantities, there were many more unable to endorse the policy of ponding water for domestic use in an open meadow, and who were most certain that the experiment must prove a failure. We have scarce had time to forget the "bog-soup" statements, and "ponded surface water" arguments against the project, and well remember the sympathizing expressions of hope that it would prove all right.

If we should employ an expert chemist to make analytical tests of the rain falling in an April shower on our watershed, and of the many springs around the reservoir basin, also, to make similar analyses of the several streams leading into the reservoir, and to test the surface water of the reservoir, the water midway between surface and bottom, and the water twenty-five feet below the surface or at the bottom of the reservoir, we should be prepared to find the lists of ingredients detected varying somewhat, their proportions varying still more, and the difference discovered between the surface and the lowest waters in the reservoir would astonish some whose attention had not before been called to the subject. Water readily associates itself with numerous compounds with which it comes in contact in its passage from cloud to sea. Falling rain-drops absorb various gases floating from over the cities; on the surface of the ground they dissolve organic and inorganic matters, and in their passage through the ground they may, according to the formations through which they percolate, meet and take up such quantities of salts of lime, iron, lead, copper, arsenic or other compounds as to become poisonous, or a source of disease to those drinking them. Rapid streams carry a variety of earthy matters down their course to the deep and still waters, and still waters carry light vegetable substances on their surfaces. Comparatively few matters that do not float remain in mechanical suspension near the surface. Their tendency is downward. Deep cisterns of hewn granite, or of porcelain, supplied with purest rain water, cannot long hold the water, subject to impure atmospheric influences, and then give from its bottom a portion as pure as when it was received.

Almost all cities have at least a few days' supply of water stored in reservoirs, hence the condition of the waters drawn from them is a subject of hygienic inquiry of almost universal interest and of exceeding importance. The history of the large storing reservoirs of several American cities records difficulties encountered with offensive water in mid-summer, and able professors have been called to investigate the causes and propose remedies. Reports represent that the deleterious effects may be traced to the presence of perishable matter in the bottoms of the reservoirs or ponds, or to the production in shallow waters of minute vegetable organisms, and to the fermentation of living vegetable organisms recently immersed in the waters. Observations also show, that impurities absorbed from the atmosphere are in many instances among the principal causes producing the unwholesome quality of the water, and that the agents tending to pollute it accumulate in greatest quantity near the bottom, where they are seldom disturbed. Organic matter, covered by a great depth of water, is so sufficiently protected from the combined action of air and moisture that its period of decomposition is extended to a great length of time. Large lakes supplied with pure waters, and with sufficient depths to keep their waters at temperatures moderately low, whose surfaces are tossed by the winds, and whose waters are dashed upon gravelly or stony beaches, are found to be palatable at their surfaces to man or beast. Hence general observation teaches us that water for domestic uses should be drawn from near the surface of the storing reservoir where it has been aerated and purified by the combined action of air and light, and only from just so far below the surface as may be necessary to avoid drawing in the floating particles. This, experience proves to be the level in the water containing the least matter in mechanical suspension, and in all respects the purest. The adjustable pipe at the dam of the Norwich Water Works, through which the water enters the main supply-pipe, was constructed with a view to determining, at the various seasons, the point from which the purest waters might be obtained; and when the growth of the city and large consumption of water shall make the surface of the lake variable in summer, it is proposed to counterbalance the tube by a float in such manner that it will be self-adjusting, and will accommodate itself, when once set at the proper level, to the varying surface of the water. During our first summer's experience in the use of the tube, while the reservoir was filling, though a large proportion of the bed of the reservoir was originally of swampy meadow and not before flowed since it had been cleared of vegetable matters, the water was always satisfactory while the tube was adjusted so as to receive the water from near the surface.

In the early part of the summer, before the counterbalancing apparatus was fully completed, the tube became accidentally lowered down to near the bottom of the lake by the wave motion of the water. It had been several days out of proper position before its movement had been discovered, and the water, at first slightly tainted, became more and more offensive as the bulb gradually approached the bottom. After it had been replaced in proper position, and the supply-pipes refilled, the water was delivered during the remainder of the summer, sweet and satisfactory.

Since the pipes have become thoroughly cleansed of particles of lime and earthy matter detached from their cement linings, the water has proved quite soft, and its action on soap and the readiness with which it produces a lather would indicate that it has not more than one or two degrees of hardness. A year's experience, in its use for domestic purposes, demonstrates that it dissolves, and absorbs the flavors of tea and coffee readily, that it is unexceptionable for use in cooking vegetables and meats, and that it is agreeable and wholesome to drink.

Accessibility.

The estimated number of inhabitants within reach of the water mains, as at present laid, is twelve thousand.

Extension of the Works.

In the lay-out of the present works, its future extension as the growth of the city shall demand, has been kept constantly in view. The present system is a beginning, complete for its time, and is also economically expansible to more than four-fold its present capacity. Its extension is a subject proper for discussion in a special report, when circumstances may show its necessity.

In November, 1868, the Board recommended that the city furnish and lay the service-pipes from the main pipes to the property lines, which was approved and authorized by the Court of Common Council. Service-Pipes.

Very few service-pipes were laid for the supply of consumers during the winter of 1868 and 1869, though a considerable number of applications had been made before the frost left the ground.

The kind of pipe adopted, and at present in use by the Board for services, is of wrought iron lined with cement, and coated with cement as laid. A contract was made with the American Water and Gas Pipe Company to line and lay the services, for the Board, until the completion and acceptance of the main pipes, and until they should have their own apparatus and employees ready to perform these works. The Board has now procured the requisite apparatus and tools, and is prepared to perform all of the labors in connection with extensions, services, and repairs, under the immediate direction of the Superintendent.

In the autumn of 1869 the six inch water-main near the junction of East Broad Street and Boswell Avenue, was struck by lightning. A large hole was torn in the ground, and the pipe was both indented and split at this point as though it had been struck with great force by a ball of about two inches diameter. The shock ruptured not less than sixty-five joints above and below the break, within a space of three hundred feet each way. Pipes struck by Lightning.

All of the works are, at present date, in effective condition. Condition of Works.

Statements are given herein of the costs of construction, to April 30, 1870; also tables, showing the streets in which pipes are laid, their lengths, and their appendages, and a table showing the quantities of the works executed at the reservoir. Tables.

Construction Account to April 30, 1870.

Land and damages		$5,664 88
Water pipes, gates and appendages		121,375 55
Labor of men and teams	$126,279 79	For reservoir...137,436 12
Tools, machinery and materials	11,156 33	
Engineering, assistants and office expenses		3,744 05
Printing, advertising, despatches and stationery		760 86
Legal services		115 00
Traveling expenses		148 91
		$269,245 37
Deduct from reservoir expenditures, cash received for tools and materials sold and labor performed for contractors,	$1,076 25	
Estimated value of construction tools remaining on hand,	500 00	
		1,576 25
Total construction,		$267,669 12

Actual cost of Reservoir and appurtenances, as per specification,		$110,257 34
Extra expenditures in connection with reservoir, not called for in specification:		
Bought 19½ acres of extra land	$873 25	
Built 51½ rods road wall, at $8 00	412 00	
Built 179 " field " at 7 00	1,253 00	
Built 62 " " " at 6 00	372 00	
Built 115 rods entrance road, at 15 00	1,725 00	
Built 118 rods board fence, at 2 75	324 50	
Built 1,200 feet post and wire fence and gates at entrance and on dam, at $0 35	420 00	
Built 3,430 cubic yards rip-rap within reservoir at foot of wall, at $2 50	8,575 00	
Built 640 lineal feet of influence culverts at $3 00	1,920 00	
Built 170 lineal feet discharge culvert below dam, at $5 50	935 00	
Clearing and improving land outside of basin	2,500 00	
Painting of fence and buildings	94 78	
1,033 cubic yards cemented priming in dam, at $6,	6,198 00	
		25,602 53
Cost of Reservoir including extra lands and works		$135,859 87

PROPOSALS RECEIVED IN RESPONSE TO ADVERTISEMENTS, FOR CONSTRUCTION OF RESERVOIR AND APPURTENANCES, AS PER SPECIFICATION.

	Aggregate Dam.	*Aggregate Reservoir.*	*Total.*
Bid No. 1. (lowest)	$19,500 75	$148,249 50	$167,750 25
" No. 2.	40,647 00	130,534 60	171,181 60
" No. 3.	35,385 50	137,225 60	172,611 10
" No. 4.	30,303 00	157,531 50	187,834 50
" No. 5.	23,080 20	194,952 70	218,032 90
" No. 6.	19,679 75	216,864 25	236,544 00
" No. 7.	47,614 00	260,434 20	308,048 20
" No. 8.	31,892 50	362,578 75	394,471 25

Table of Pipes and Appendages,

LAID AND SET

To April 30th, 1870.

	PIPES.					GATES.					Blow-Offs			Hy-dr'nts		Air Vlvs.	
	14 in.	*10 in.*	*8 in.*	*6 in.*	*4 in.*	*14 in.*	*10 in.*	*8 in.*	*6 in.*	*4 in.*	*10 in.*	*6 in.*	*4 in.*	*Doub.*	*Sin.*	*1½ in.*	*½ in.*
Ann				25.	666.										1		
Asylum				1049.	30.				1						2		
Bath					451.5					1				1			
Boswell Avenue				1737.5	7.				2						1		1
Broad				1775.5	46.				2						2		1
Broad, East				2592.	14.				1						2		1
Broadway		2367.5	1326.5	2008.	142.5			2	1					1	5		
Cedar					304.5					1					1		
Chestnut					687.5					1			1		1		
Church				1280.	14.				2						2		
Cliff				1282.	113.				1	1							
Cove					216.								1		1		
Commerce				334.					1								
Elm					346.										1		
Ferry					226.5					1					1		
Franklin				3896.	71.				3					1	3		
Grove					640.					1							
High					2422.5					2					2		
Huntington Avenue					619.					1					1		
Lafayette				2864.	23.				2						2		
Lincoln Avenue					1014.					1					1		
Main		1784.	889,5		119.		2			1				6			
Main, East				2318.5	35.				2						4		
Main, West				2365.5	48.5			1	1					2	4	1	
Market				480.	14.				1					1			
Maple					439.				1								
Norton Alley					193.5									1			
Oak				1106.5	38.				1						1		1
Oneco					818.5												
Otis					891.					1							
Park				556.5	344.5				1						1		
Roath					300.					1					1		
Rockwell					305.					1							
Rose Place					186.5								1				
Sachem				2055.	41.				2				1	1	1		
School				1043.	424.5				1						1		
Sherman				401.	8.										2		
Shetucket				804.	42.				1			1		2	1		
Spalding					536.					1							
Spring					1076.5					1					2		
Thames				3363.	1222.				2						6		
Thames, North					401.												
Town, and in Fields	8901.5	22.		398.	40.	2					1	1	2			5	
Uncas					776.										1		
Union				2010.5	126.				3						2		
Warren					528.					1							
Washington		5204.			161.		2							1	7	1	
William					525.					1					1		
Williams Avenue					1664.					2					1		
Willow					513.					1							
Water				1097.	36.5				2					1	2		
At Reservoir Dam						2	1	1									

Total of Pipes and Appendages, April 30th, 1870.

14 inch Pipe, 8,901.5 feet, at $2 32	$20,651 48
10 inch " 9,377.5 feet, at 1 74	16,316 85
8 inch " 2,216. feet, at 1 41	3,124 56
6 inch " 36,841.5 feet, at 1 14	41,999 31
4 inch " 19,907. feet, at 0 88¾	17,667 46
14 inch Gates, 4, at $112 00	$448 00
10 inch Gates, 5, at 70 00	350 00
8 inch Gates, 4, at 56 00	224 00
6 inch Gates, 33, at 42 00	1,380 00
4 inch Gates, 22, at 28 00	616 00
10 inch Blow-offs, 1, at $70 00	$70 00
6 inch " 2, at 42 00	84 00
4 inch " 6, at 28 00	168 00
Double Hydrants, 18 Single " 67 } 85 at $60 00	$5,100 00
1½ inch Air Valves, 7 ½ inch " " 4 } 11 at 20 00	220 00
	$108,419 66

Memoranda of Variations from Original Estimates of Pipes, &c.

14 inch Pipe, increase 1.5 feet, at $2 32		$3 48
10 inch " " 202.5 fcet, at 1 74		352 35
6 inch " " 1,346.5 feet, at 1 14		1,535 01
4 inch " " 11,542. feet, at 0 88¾		10,243 52
8 inch " decrease 2,004. feet, at 1 41	$2,825 64	
GATES INCLUDING BLOW-OFF GATES.		
10 inch Gates, increase 1, at $70 00		$70 00
6 inch " " 21, at 42 00		882 00
4 inch " " 18, at 28 00		504 00
8 inch " decrease 2, at 56 00	$112 00	
Balance of increase on Pipes and Appendages,		$10,652 72

ADDITIONAL SMALL PIPES LAID FOR TEMPORARY DISTRIBUTION.

Division Street	751. feet.
Roath Avenue	181. "
Summit Street	360. "
Baltic Street	492.5 "
Reynolds Avenue	50. "
William Street	198. "
Perkins Avenue	331. "
	2,363.5 feet.

Total number of services laid, to April 30th, 1870	365
Total length of service pipe laid, to April 30th, 1870	8352 feet.

Amount of Pipes and appendages as per original contract	$96,676 94
Additional Pipes and appendages ordered by the Common Council	10,652 72
Extra Pipes, Gates and Hydrants, Freight and Repairs	3,794 99
Pipes and fixtures in Dam	2,929 10
Cost of Service Pipes laid	7,321 80
Total of Pipes, Gates and appendages	$121,375 55

Memorandas of Quantities, in Reservoir Dam.

1,680	cubic yards excavation for foundations.
18,000	" " earthwork.
2,300	" " earth grading around dam.
27½	" " dressed masonry.
642	" " dry masonry.
659	" " rip-rap.
1,364½	" " cemented masonry

MEMORANDA OF OTHER QUANTITIES IN RESERVOIR.

62	acres cleared of brush.
56	" " of 19,600 stumps.
109,707	cubic yards of earth grubbing on bed of lake.
2,469	" " excavations for wall foundations.
4,283	" " " for brook courses and ditches.
282	" " " for waste way.
165	" " " of solid rock.
1,567	" " of dry laid masonry in 47 culverts.
560	square yards paving in 47 culverts.
10,266	cubic yards dry laid masonry in reservoir wall.
26,500	" " earthwork in reservoir road.
1,666	" " loose stone moved and wasted.
1	office, 1 shop and sheds built.
3,430	cubic yards of slope wall built.
2,658	lineal yards of permanent stone and wire fencing.

The above descriptive memoranda of Engineering Works, together with the statements and tables appended thereto, are respectfully submitted for the consideration of the Board of Water Commissioners.

J. T. FANNING,
Engineer.

Norwich, Conn., April 30th, 1870.

Income from Water.

Regular rents, due and payable, July 1st, 1869	$505 00
" " " " " October 1st, 1869	1247 15
" " " " " January 1st, 1870	1340 94
" " " " " April 1st, 1870	1567 55
	$4660 64
Builders' rates, to April 1st, 1870	$302 69
Extra per centage from delinquents to April 1st, 1870	16 75
	$4980 08

Received from other sources to March 31st, 1870:

From American Water and Gas Pipe Co., for labor	$819 93
From C. B. Rogers & Co., for labor	23 24
For tools and materials sold on construction account	310 51
	$1153 68

Maintenance Account to March 31, 1870.

Paid for Labor of Men and Teams		$1856 49
" Tools and Materials		414 37
" Superintendence		1016 10
" Printing and Advertising, " Stationery and Postage,		244 98
" Rents of Office and Shop		176 67
" Express and Freight		97 22
Total		$3805 83
Deduct extra expense of re-clearing margin of reservoir of grass and weeds, while filling	$653 00	
Deduct extraordinary cost of repairing pipes, injured by lightning, near intersection of Boswell Avenue and East Broad Street	295 80	
Deduct amount received from American Water & Gas Pipe Co., for labor performed	819 93	
Deduct amount received from C. B. Rogers & Co., for labor performed	23 24	
		1791 97
Actual maintenance		$2013 86

Summary of Water Consumers, March 31, 1870.

Number of	Families supplied	378
"	Offices and Stores	104
"	Manufactories	10
"	Printing Offices	3
"	Saloons	11
"	Schools	7
"	Steamboats	2
"	Railroad Company	1
"	County Jail	1
"	Livery Stables	8
"	Private Stables	36
"	Horses	160
"	Cows	12
"	Fire Engine Houses	6
"	Fire Cisterns and Water Troughs	22
"	Photograph Saloons	3
"	Markets	4
"	Steam Engines (69 H. P.)	8
"	Private Fire Plugs	29
"	Graperies and Greenhouses	3
"	Steam Heaters	3
"	Fountains	6
"	Street Washers (2917 feet front)	31
"	Garden Hydrants (99,800 square feet area)	14
"	Baths	67
"	Water Closets	110
"	Urinals	26

Annual income from regular rents as per consumption at this date $6302 80

The above statements of cost of maintenance and amount of income, and of water consumption, are respectfully submitted for the consideration of the Board of Water Commissioners.

H. B. WINSHIP, Superintendent.

Norwich, April 1st, 1870.

ALBA F. SMITH,
JEDEDIAH SPALDING,
JAMES S. CAREW,
HENRY L. CLARK,
P. St. M. ANDREWS,

Board of Water Commissioners.

RULES AND REGULATIONS

MADE BY THE

BOARD of WATER COMMISSIONERS of the City of Norwich,

UNDER AN ACT ENTITLED "AN ACT TO PROVIDE FOR A SUPPLY OF PURE AND WHOLESOME WATER IN THE CITY OF NORWICH," PASSED 1866.

At a meeting of the Board of Water Commissioners of the City of Norwich, held October 26th, A. D. 1868, the following Rules, Regulations, and Tariff of Water Rates were adopted, and respectfully submitted to the Honorable Court of Common Council, for their approval.

Attest,

J. T. FANNING,
Secretary Board of Water Commissioners.

GENERAL CONDITIONS.

RULE I.—Applications.

All applications to the Board of Water Commissioners of the City of Norwich for water, or for any additions to, or alteration of fixtures, must be written in the prescribed form, and must state fully and truly the location where, and all the purposes for which water is required. No additions to, or alteration of fixtures, are to be made without a permit from the Commissioners.

Water will not be introduced into any building or premises occupied by a tenant without the consent of the owner or owners thereof, first had and obtained in writing.

Contracts will not be made for a longer term than three years.

RULE II.—Inspection and Approval.

All apparatus and locations, supplied with water, must be accessible and open to the inspection of the Commissioners or their agent, at all times. When inspections of fixtures are made, or rents are paid, parties must frankly answer questions relating to conditions of fixtures or consumption of water.

All water apparatus, or fixtures, shall be subject to the inspection and approval, or the rejection of the Board, as to the location, pattern, strength, material and workmanship.

RULE III.—Regular Rents.

The regular water rents, except for building purposes, shall be due and payable at the office of the Commissioners quarterly, on the first day of each January, April, July and October. The amount of each rent remaining unpaid twenty days after due will be increased five per cent., and one per cent. per month interest will be charged on the original amount thereafter until paid.

Each rent due for water shall be and remain a lien upon the building or lot wherein, or in connection with which, said water shall have been used.

RULE IV.—Right to Shut off Water.

The Commissioners hereby reserve the right to shut off the water to make extensions, alterations or necessary repairs. In case of misrepresentation, misuse or waste of water, or in case of disregard or violatian of any rule or regulation for the supply of water, duly approved by the Court of Common Council, the Commissioners shall have the right to shut off and withhold the supply, without further notice, until they shall be satisfied that there will be no further cause of complaint, and the party offending shall have paid the fine prescribed, and an additional sum of five dollars expense for shutting off the water.

RULE V.—Pipes Protected.

All persons taking water must keep their own fixtures, service pipes from the main, and stop-cock, curb and cover on the side-walk in good repair and fully protected from injury by frost, and must prevent all waste of water.

All persons are forbidden to let water run continuously in any case to guard against freezing, except by special agreement with the Commissioners for the purpose.

RULE VI.—Hydrants, Fountains, &c.

Street or garden washers, or private hydrants are not to be so used at any time as to create a nuisance or cause injury to a neighbor or passer-by, and shall only be used judiciously, without excessive waste.

No fountain or jet shall be in use more than three hours in a day, or during more than one hundred and twenty different days in a year, without a special permit and an additional payment beyond the established rate.

The Commissioners reserve the right to suspend, or discontinue the use of any fountain or jet, when public interest shall require it.

RULE VII.—Builder's Report.

Each builder or superintendent of building using water supplied from these works shall, on or before the last day of each month, render at the Commissioners' office full and true accounts of all waters used by him for building purposes on jobs completed during said month; and it shall be the duty of each contractor or the owner, when work is done by days' work, to pay, at the office of the Commissioners, for the water used, on the first day of the next succeeding month, which payment when made to the satisfaction of the Commissioners shall be a full discharge to the owner of the building.

RULE VIII.—Meters.

The water-rates are predicated on supplying water for *domestic* purposes at *thirty cents per thousand gallons;* for *manufacturing* purposes at *twenty-five cents per thousand gallons;* and for *special* purposes, requiring large quantities, at *twenty cents per thousand gallons.*

The Commissioners hereby reserve the right to ascertain, by meter, when they shall deem it for the interest of the City, the quantity of water used by any party, and to contract with said party at the established meter-rate.

RULES RESPECTING PLUMBERS.

RULE IX.—Opening Trenches.

Whenever any street or public ground shall be opened for making a connection, or for laying any water-pipe or fixture, public safety and convenience shall be duly regarded; and the back-filling shall be thoroughly settled with rammers, and the pavement, if any, relaid within twenty-four hours from the time the connection is made, and the location be kept in a condition satisfactory to the Street Commissioner for two months thereafter.

RULE X.—Taps.

Taps and connections of service-pipes shall only be made by persons duly authorized by the Commissioners. No person shall make any tap or connection, or conduct water to any premises not provided for in a permit already issued, without a special permit, under a penalty of Fifty Dollars.

RULE XI.—Stop Cocks, Curbs, &c.

There shall be a corporation-cock next to the main, and an approved cock of the same bore within the curb-line.

All stop-cocks, except those next to the mains, or within buildings, and all valves, street-washers and private hydrants shall be fitted with curbs and covers similar to the patterns deposited in the Commissioners' Office.

RULE XII.—Valves.

All valves for water-closets and urinals must be submitted to the Inspector of the Board; and no water-closet or urinal shall be supplied with water unless the valves shall have been inspected and approved.

RULE XIII.—Connections.

The plumbing, fixtures, and service-pipes of all the buildings or premises where water is desired must be completed before a service-pipe shall be connected to any supply-pipe, and no connection shall be made for the supply of any building or fixture until the plumbing shall have been inspected and approved by the Commissioners or their agent.

RULE XIV.—Plumber's Report.

Every plumber who shall set up any pipes or fixtures for the use of water from these works shall, within five days after the same shall be completed, fill up and return to the office of the Commissioners the printed report-blanks, which may be procured at their office, showing and describing all the arrangements, both old and new, for the use of water on the premises.

PENALTIES.

RULE XV.—Sale of Water.

No party to whom water is supplied shall have the right to sell or furnish water to any person or persons, except to aid in the extinguishment of fires, unless by special agreement with the Commissioners, on penalty of paying double rates therefor.

RULE XVI.—Opening or Obstructing Hydrants or Stop-Cocks.

All persons are forbidden to obstruct free access to any public fire-hydrant, or stop-cock, or to use water therefrom, except in case of fire, without permission from proper authority, or to open or disarrange any public hydrant or stop-cock, on penalty of Thirty Dollars.

RULE XVII.—Turning on Water.

No person shall turn on the water, at either a corporation or private stop-cock when it has been shut off by order of the Commissioners on account of waste, defect in fixtures, disuse, or disregard or violation of rules and regulations until all expenses and fines therefor are paid, all causes of complaint remedied, and a special permit obtained therefor, under a penalty of Ten Dollars.

RULE XVIII.—Injury to Reservoir or Mains.

No person shall fish in, or launch any boat, or sail on, or remove ice from the waters of the reservoir, without permission from proper authority: and no person shall divert water from, or pollute any water running to, or in the reservoirs or mains, or shall injure any fixture or appurtenance of the reservoir or mains, on penalty of Fifty Dollars.

RULE XIX.—General Fines.

The fine for disregard or violation of any of the above rules and regulations, when not otherwise specified, shall be, in addition to shutting off and withholding the supply of water, Five Dollars.

RULE XX.—Police.

It shall be the duty of the Police of the City of Norwich to exercise a vigilant supervision over the use of water, to prevent waste of water, to report to the Commissioners leaks or breaks in the mains or service-pipes, the locations of street-washers or curbs without covers, and to attend all fires in their respective districts and see that the hydrants are properly closed when no longer in use.

WATER-RATES.

Regular rates for the use of water, where the fixtures are within the premises supplied, will be due and payable at the office of the Commissioners quarterly, on the first day of each January, April, July and October.

The amount of rates per annum will be as follows, viz:

Dwelling, Tenement and Boarding Houses, for each family not exceeding five persons,	$5 00
Each additional person	1 00
Hotels, per special contract.	
In each Dwelling, Tenement, and Boarding House there will be additional charges as follows:	
For each Water Closet,	$3 00
For each Bath Tub,	3 00
For each Urinal,	2 00
Public Baths, for each Tub,	5 00
Eating Houses, not including jets or fountains,	10 00 to 30 00
Soda Fountains, each	12 00
Markets and Stalls,	8 00 to 20 00
Barbers' Shops,	5 00 to 25 00
Jets and Fountains, per meter measurement or special contract.	
Banks and Home Insurance Offices,	6 00 to 12 00
Professional and Agency Offices,	5 00 to 10 00
Photographic Galleries,	10 00 to 20 00
Wholesale, Retail and Commission Stores,	5 00 to 15 00
Building Purposes:—	
For each thousand of brick,	0 10
For each cubic yard stone mortared masonry,	0 05
For each hundred yards plastering, per coat,	0 35
For general building purposes, per bbl.,	0 06
Steam or Hot Water Heating Apparatus, for private dwellings,	5 00
Iron Foundries and Chemical Works, per special contract, or by meter measurement.	
Mechanic Shops and Establishments,	5 00 to 25 00
Water Power per special contract, or by meter measurement.	

Steam Engines, high pressure, run not exceeding twelve hours per day, for each horse power, not exceeding ten,	5 00
Do, exceeding ten horse power,	4 00
Street and Building-Front Washers, not exceeding 1-4 inch nozzle, per foot front,	0 06
Yard and Garden Hydrants, not exceeding 3-16 nozzle, per 1,000 square feet area,	50
Private Fire Plugs, to be used only in case of Fire :—	
1-2 inch tap,	3 00
1 inch tap,	5 00
1 1 2 inch tap,	8 00
2 inch tap,	12 00
Private Stables, including carriage-washing without hose :—	
Not exceeding two horses,	4 00
Each additional horse,	2 00
For use of hose—each horse,	1 00
For each cow,	1 50
Livery and Sale Stables :—	
For each horse, without hose,	2 00
For each horse, with use of hose,	2 50
Dray, Car and Omnibus Stables, each horse,	1 50
Railroads and Shipping, per special contract.	

Not more than twenty-five per cent. discount will be allowed from the above fixed rates when supplies are taken from yard fixtures, or without the premises.

Rates for all purposes not enumerated in the foregoing tariff, per special contract.

METER-RATES FOR SPECIAL PURPOSES.

Not exceeding 15,000 gallons annually, 30 cents per 1,000 gallons; exceeding 15,000 gallons and not exceeding 20,000 gallons annually, 25 cents per 1,000 gallons; exceeding 20,000 gallons annually, 20 cents per 1,000 gallons.

At a meeting of the Court of Common Council of the City of Norwich, held on the 2d day of November, 1868, the following resolution was adopted:

Resolved, That the Rules, Regulations and Tariff of Water Rates adopted by the Board of Water Commissioners, October 26, 1868, in pursuance of "An Act to provide for a supply of pure and wholesome water in the City of Norwich," passed 1866, be and the same are hereby approved.

Attest,

JOHN L. DEVOTION,
City Clerk.

N101
.130

1879. City of Norwich Water Works. No. 6.

REPORT

OF THE

Superintendent of the City of Norwich Conn Water Works,

TO THE

Board of Water Commissioners,

From April 1, 1878, to March 31, 1879.

H. B. WINSHIP, Superintendent.

NORWICH:
BULLETIN CO. PRINT,
1879.

1879. City of Norwich Water Works. No. 6.

REPORT

OF THE

Superintendent of the City of Norwich Water Works,

TO THE

WITH RESPECTS OF

H. B. WINSHIP,
Sup't.

PLEASE EXCHANGE.

NORWICH:
BULLETIN CO. PRINT,
1879.

1879. City of Norwich Water Works. No. 6.

REPORT

OF THE

Superintendent of the City of Norwich Water Works,

TO THE

Board of Water Commissioners,

From April 1, 1878, to March 31, 1879.

H. B. WINSHIP, Superintendent.

NORWICH:
BULLETIN CO. PRINT,
1879.

By the adoption of the above noted practice of other New England cities and towns, as to the distribution of expenses, the result would show in our own case as follows, viz:

Net income for all uses of water other than fire purposes, .		$1,7695 73
For use of 241 fire hydrants at $30 00 each, . . .		7,230 00
		$24,925 73
The whole outlay for constructing our Water Works to March 31, 1879, is	$390,316 83	
Interest on same at 6 per cent., ...		23,419 00
Surplus for the year over and above interest and cost, and expense of operating and maintaining, ...		$1,506 73

Practically, the change here proposed of rendering City accounts is simply a matter of book-keeping, and adds nothing to expenses. Were our Water Works constructed as a private enterprise, we are decidedly of the opinion that no property holder would forego the use of the fire hydrants on account of *his proportion of their cost*, at a rental of thirty dollars per year.

The recommendation contained in the report of the Superintendent for laying an additional 16-inch cast iron main, from Fair View Reservoir to the north end of Williams Park, with all requisite connections, (the estimated cost of which, $19,500 00, is appended to the Superintendent's report,) this Board fully concur in, and believe its early accomplishment of serious importance to the City's interest. Holding this view of the necessity for the improvement, we commend it to the careful consideration and early determination of your Honorable body.

The following are some of the many reasons why this improvement should be made at an early day; very early, as in the future the additional main will become an absolute necessity in order to furnish the rapidly extending system of distribution with a tolerable reliable head on pressure, even for ordinary uses, to say nothing of the entire lack of effective head there will be for fire purposes in the higher locations, with only the present main.

The capacity of the present 14 inch main is now insufficient to support an effective pressure for fire uses in the higher portions of the City, with even but few hydrants open in the lower district, which is liable to occur at any time.

The pressure in the distributing pipes is gradually lessening by reason of the constantly increasing draft of water, and must continue to lessen more and more rapidly as the draft of water increases.

With the additional main, (which alone would have a measured capacity of nearly 25 per cent. more than the present main), the two can be used independently of each other--one to supply the high and the other the low districts, each district having the full head due to their respective elevations—or the two mains can be used in common, yielding at least double the effective pressure when a large draught is taking place, as in case of large fires, when it is most needed.

Having two mains, double security is had against a possible failure of supply by accident, to which all large pipes under great pressure are liable. This improvement must inevitably be made when an additional supply of water is necessarily had in the present Reservoir, whatever plan may be adopted to get the additional water there.

The present cost of the proposed main, and its necessary connections, can now be had and completed at a lower cost than ever before known, except, perhaps, during the past year; and no doubt much cheaper than in the future—the prices are already tending upward. The present cost of this improvement would now be ($19,500 00), not over one-third the amount it would have cost at the time the Works were originally built, and the relative cost at this time, of cast iron pipe and the patent wrought iron and cement pipe, is much more in favor of the former kind than heretofore. Hence, it is deemed advisable to use cast iron pipe at this time. When the Resrervoir was built, a 16-inch cast iron main was properly laid through the dam, of some 200 feet in length, with a view to its future extension as now proposed, to the junction of Broadway and Washington Streets—the point where the 14 inch main now terminates.

Respectfully,

A. F. SMITH,
JAS. S. CAREW,
WM. M. WILLIAMS,
C. D. BROWNING,
H. L. PARKER,
Board of Water Commissioners.

REPORT--1879.

To the Board of Water Commissioners :

Gentlemen : In accordance with the usual custom, I have the pleasure of presenting you a report of the operations of our Works, together with statements of receipts and expenditures for the year ending March 31, 1879.

RESERVOIR.

At the beginning of the year the water was 40 inches below high water mark. May 9, it was 22 inches below ; this was the highest point for the year. November 19, water was down 94 inches, which was the lowest point for the year ; since this date the water has risen, until at this date, (March 31), it is down only 44 inches, and steadily rising. Taking into consideration that the rain-fall for the year was nearly ten inches less than for the year previous, and less than any year since 1871, and the least, with one exception, of any year since our Works were put into operation. It is readily seen that the waste has been largely stoped, and that there can be no leaks on our mains. The drain which was built late in the fall of 1877, across land of C. C. Bliss, has proved all that was claimed for it, and is worth many times its cost in enabling us to secure a large supply, which has heretofore been lost by evaporation from the extended surface to which rain-fall of this district was exposed.

We now get the rain-fall of this section to our Reservoir quickly, not allowing it to waste or gradually become laden with vegetable matter to be carried to the basin, there to ferment and produce the unpleasant taste and odor which at times is so unpleasant and annoying. If it were possible to do the same on all the water-courses about the Reservoir the quality of the water would be greatly improved. Each year, when this unpleasant taste and odor has appeared, it is gradually less each time, and I have never doubted that with proper and intelligent care it may, to a great extent, be avoided.

I have built a light iron bridge, to be put in place of the old timber and plank walk from the dam to well-house, and shall put it in position very soon.

Early in January, 1878, I found that one of the main gates was out of order, and it was necessary to take up the dome of the 10-inch gate and repair it. This was done, at the same time the supply to the City was maintained by a careful handling and adjusting the supply through the 14-inch gate. To avoid danger from this source again, a valve was arranged with wire rope to the well-house, by which the pipe may be closed at the Reservoir end. To put this in position, as well as to close the end of the pipe to repair the gate, required the service of sub-marine divers. Mr. George W. Fuller was employed, and he accomplished the work in three days' diving.

The roads, walls, fences, and buildings are all in good order and repair.

The expenditures have been:

For roads, fences, and water courses,	$35 50
Valve outside of well-house and in Reservoir, including the repairs to 10-inch gate,	237 37
	$272 87

There has been sold from the grounds grass, &c., amounting to $50 00, none of which was paid early enough to be included in accounts for this year.

RECORD OF RAIN-FALL.

	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Monthly Average.
April,	2.10	1.83	4.76	8.98	4.47	5.25	3.16	6.75	4.66
May,	2.26	3.31	6.37	5.09	3.16	2.96	2.18	2.95	3.17
June,	3.80	3.66	.27	3.67	3.48	1.36	7.80	3.38	3.83
July,	1.97	5.39	2.25	4.48	2.28	10.00	2.37	2.92	3.81
August,	5.16	6.48	6.99	13.30	6.41	.85	7.15	3.21	6.19
September,	1.10	7.61	3.18	2.91	2.61	6.85	.46	2.08	3.10
October,	6.96	4.38	7.90	1.16	5.52	1.51	9.45	4.22	5.10
November,	6.38	6.12	5.71	3.43	7.57	5.33	9.14	5.49	6.14
December,	3.58	5.18	6.37	3.20	1.20	4.34	2.60	5.43	3.86
	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	
January,	3.60	9.01	5.08	3.55	1.74	3.91	5.72	3.14	4.47
February,	1.80	6.73	5.34	5.63	5.23	1.42	3.84	4.46	4.31
March,	1.51	2.81	1.80	6.80	11.79	13.18	3.99	3.89	5.72
Total,	40.22	62.51	56.02	62.20	55.46	56.96	57.86	47.92	
Aver'ge per mo.	3.35	5.21	4.67	5.18	4.54	4.75	4.82	3.99	

1870.

Full January 16 ; lowest point to which water was drawn, December 1, 62 inches.

1871.

Full May 5; flash-boards on 8, and 6 inches more than full; lowest point to which water was drawn, February 11, 69 inches.

1872.

Highest point April 15, 29 inches below high water; lowest point to which water was drawn, December 29, 88 inches.

1873.

Full May 13; lowest point to which water was drawn, October 17, 94 inches.

1874.

Highest point June 1, 10 inches below high water; lowest point to which water was drawn, January 13, 54 inches.

1875.

Full May 5; lowest point to which water was drawn, November 7, 71 inches.

1876.

Full April 2; lowest point to which water was drawn, December 15, 100 inches.

1877.

Highest point April 30, 41 inches below high water; lowest point to which water was drawn, March 1, 126 inches.

1878.

Highest point May 9, 22 inches below high water; lowest point to which water was drawn, October 4, 102 inches.

1879.

Highest point March 30, 44 inches below high water and steadily rising; lowest point to which water was drawn, November 19, 94 inches.

PIPES.

Our distribution pipes are all in good condition and repair, and I know of no indications of failure in any part of the City, with perhaps the exception referred to in my report last year, (West Thames Street, at Thamesville). There has been 34 leaks repaired during the year, but one of them on the 14-inch main, (a hydrant branch broke off.) The cost of these repairs, including a band and 4-inch gate for hydrant on 14-inch, in place of one broke off, was $379 56.

The leaks repaired were on the following named streets:

West Thames,	cement,	2
Yantic,	cement,	2
Central Wharf,	iron,	3
Main,	cement,	3
Ferry,	cement,	2
Union,	cement,	2
Chestnut,	iron,	1
Newton,	cement,	5
West Main,	cement,	2
High,	cement,	2
Town, 14-inch,	cement,	1
Norton Alley,	cement,	1
Summit,	cement,	1
East Main,	cement,	1
Bath,	cement,	2
North Thames,	cement,	1
Erin,	cement,	1
Franklin,	cement,	1
East Broad,	cement,	1

EXTENSIONS.

Extensions have been laid in the following named streets:

Chestnut,	84	feet
Prospect,	271	feet
Cove,	142	feet
North Cliff,	275	feet
Laurel Hill Avenue,	70	feet
Seventh,	123.5	feet
Collins,	199	feet
Prentice Lane,	440	feet
Extensions to March 31, 1879.,	1,604.5	feet
Whole length of pipe laid to March 31, 1878,	146,867	feet
Whole length to March 31, 1879,	148,471.5	feet

More than 28 miles.

STREETS.	14 inch.	10 inch.	8 inch.	6 inch.	4 inch.	1½ inch.	1¼ inch.	1 inch.	¾ inch.	½ inch.
Shetucket				804.	49.					
Spalding					536.					
Spring					1262.5					
Summit					1029.1		188.5	98.	221.5	
Shipping					579.					
Slater Avenue				388.	8.					
Summer					1249.					
Thames				3363.	2112.					
Thames, East					493.5					
Thames, North					401.					
Talman								280.		
Town, East and fields	8901.5	22.			40.					
Town, West				398.						
Uncas					776.					
Union				2010.5	175.					
Warren					528.					
Willow					513.					
Washington		5204.			222.5					
William					525.			468.5		
Williams					1664.					
Water				1097.	36.5					
Walnut					242.					
Ward					707.					
Winchester					438.					
Yantic				2432.	116.					
Second				558.5						
Third					294.5					
Fourth				774.	531.					
Fifth				643.5	528.					
Sixth				887.	410.					
Seventh				295.	123.5					
Eighth					297.				204.5	
Ninth				544.5						
Tenth				962.5						
Eleventh					524.					
Twelfth				927.5						
Erin					309.					

GATES AND HYDRANTS.

The gates are all in perfect order, and, with the exception of springing the spindle on ten-inch at Reservoir, and raising or lowering curbs, to conform to changes of street grades, they have not required any repairs.

All of our gates are from the Boston Machine Co., and, from their peculiar action it is almost impossible to get them out of order. I notice, in many reports received this season, a complaint of other makers' gates leaking when closed, and others difficult to close or open—we have no such trouble.

March 31, 1878, there were set and in use 221 gates, during the past year 8 gates have been set. Total at present time, 229.

The hydrants are now all in good order. The extreme and long-continued cold of last winter caused an unusual amount of care and labor to prevent, as far as possible, freezing; but in spite of all our watchfulness we had several hydrants frozen, though none for any great length of time. One on the corner Main and Shetucket Streets was disabled by breaking of under plate of valve and rod ears, and has been replaced by a new one. Several hydrants have been removed to conform with curb lines.

Two new hydrants with valves, closing against the pressure, have been set, one on Main and one on Thames street.

March 31, 1878, there were set and in use 238 hydrants. During the year 3 hydrants have been set. Total at present time 241; of this number 9 are located on Laurel Hill, 46 in Greeneville, above Roath street.

LOCATION OF HYDRANTS.

CITY.

Ann St., corner Pearl St.
" corner Coit St.
Asylum St., corner Maple St.
" opposite Alice St.
" front John Maples' house
" corner Town House Lane.
" corner Monroe St.
" opposite Vernon St.
" opposite west end of bridge.
Bath St., front Hilton & Bidwell's shop.
Boswell Av., front Wm. Noss' house.
" front Hose House No. 4.
" opposite corner Roath St.
Broad St., opposite Cedar St.
" opposite Dr. Haile's house.
" corner Franklin St.
Broad St., East, corner Warren St.
" " corner Spalding St.
" " corner Grove St.
Broadway, corner Williams Park.
" corner Rockwell St.
" corner Broad St.
" opposite Perkins Av.
" opposite Catholic Cathedral.
" opposite Huntington Place.
" front Frank Johnson's house.
" front Broadway School House.
" opposite Willow St.
" corner Union St., Court House.
Cedar St., front Jail.
" near corner of Happy St.
" near top of Hill.
" near Fountain St.
" near Slater Av
Chestnut St., near Willow St.
" rear of Broadway Church.
" rear of School House.
" front of Spalding's block.
Church St., near Trinity Church.
" near Second Cong. Church.
" near Otis Library.
Cliff St., opposite Elm St.
" front Dr. Buckley's.
" near corner of North Cliff St.
" corner Oak St.
Cove St., corner North Thames St.
" west from High.
Coit St., corner Fairmount St.
Court St., corner School St.
Central Wharf, near corner Main St.
" " near end of wharf.
Division St., near corner Prospect Av.
" opposite Arnold St.
Elm St., opposite Hill St.
Elizabeth St., corner Peck St.
" first corner above Peck St.
" corner Mt. Pleasant St.
Ferry St., corner Railroad Av.
Franklin St., near corner Bath St.
" corner Willow St.
" corner Harvey Av.
" Park and Boswell Av.
" front Ansel Clark's house.
" front Hall's block.
" corner Otis St.
" opposite Warren St.
" front I. M. Bidwell's house.
Fairmount St. corner Pearl St.
Fountain St., betw'n School & Happy Sts.
" near corner Happy St.
" near Cedar St.
Grove St., front E. M. Brewster's house.
High St., West, opposite Spring St.
" " corner Summit St.
" " front Mrs. Story's house.
" " corner Mt. Pleasant St.
Huntington Place, west end of Park.
" " east end of Park.
Lafayette St., opposite Sachem St.
" front C. H. Allen's house.
" corner Williams St.
" opposite C. F. Berk's house.
Lincoln Av., opp. J. Hunt Smith's house.
" near John L. Boswell's house.
Main St., east corner Franklin Square.
" west corner Franklin Square.
" opposite Market St.
" front of Engine House.
" front Nash, Brewster & Co's.
" C. H. Hulburt's store.

Main St., East, corner Cliff St.
" " front Z. C. Crowell's house
" " corner Park St.
" " south corner R. R. shops.
" " in front of R. R. shops.
Main St., West, corner North Thames St.
" " corner North High St.
" " near Engine House.
" " corner Fairmount St.
" " front C. J. Winters' stable
" " corner Ann & Maple Sts.
" " corner Asylum St.
" " front Smith's stable.
Market St., corner Water St.
" corner Commerce St.
Maple St., opp. W. D. Bottom's house.
" top of hill.
Mt. Pleasant St., corner of Ward St.
" opposite Avery St.
" opposite Quarry St.
" corner West Main St.
Norton Alley, on the docks.
Newton St., top of hill.
" opp. J. H. Whitney's house.
North Cliff, first corner.
Oak St., corner Division St.
" corner Roath Av.
Otis St., near Broadway.
Park St., corner Cliff St.
" corner Roath Av.
Pearl St., opposite School House.
Peck St., front of Peck's house.
" front R. B. Parker's house.
Roath St., near Division St.
" near soap factory.
" between Cliff and N. Cliff Sts.
" corner Cliff St.
" corner Main St.
Rockwell St., corner Crescent St.
Sachem St., opposite Oneco St.
" near corner Reynolds Av.
" front of church.
" corner Washington St.
" opposite Fountain St.
Sherman St., front of engine house.
" opposite pipe shop.
" east end of bridge.
Spring St., near rope walk.
" near Mechanic St.

Shetucket St., corner Main St.
" opposite Water St.
" opposite American House.
" front of freight depot.
Summit St., front J. P. Miner's house.
" ner G. C. Bill's house
Shipping St., Thamesville depot.
Slater Avenue, front C. J. King's house.
Thames St., opposite C B. Rogers & Co.
" front Mrs. J. A. Story's house
" front Richmond Stove Works
" east J. P. Collins & Co's shop
Thames St., West, near M. F. Bent's house
" front G. Kinney's house.
" front J. Mitchell's house.
" front R. Huntington's house.
" corner Shipping St.
" at City line.
Uncas St., corner Williams St.
Union St., opposite engine house.
" front H. L. Clark's house.
" front John Eggleston s house.
" opposite David Young's house.
" end Little Plain.
Washington St,, Breed Hall corner.
" opposite J. A. Morgan's h.
" opposite School St.
" front of Lee house.
" opposite L. Blackstone's h
" corner Yantic St.
" opposite W. A. Aiken's h.
" front L. Ballou's house.
" front H. B. Norton's h.
" opposite Lincoln Av.
" opposite Williams St.
Williams St., corner Oneco St.
Water St., front J. P Barstow's store.
" corner Commerce St.
" front E. C. Cook's store.
" near south end of street.
Yantic St., near corner Manning St.
" opposite old engine house.
" opposite Falls Co's brick block.
" opposite Falls Co's offices.
" corner alley to mills.
" west side of street towards Washington St.
" west side of street towards Washington St.

There are, in addition to the above, six private hydrants of the same style and couplings, and subject to general use in case of fire, located as follows:

Pistol shop at Falls, two in front of buildings.
Steamboat dock, near corner of depot.
Railroad repair shops, two in rear of buildings.
Norwich lock shops, rear of buildings.

GREENEVILLE.

Erin St., end of street.
High St., between Main and Bachelder's corner.
" Bachelder's corner.
" near Second St.
" corner Third St.
" between Fifth and Sixth Sts.
" corner Seventh St.
" corner Ninth St.
" corner Eleventh St.
" near Twelfth St.
" corner Main St.
Main St., front of gas works.
" front of Kelly Bros'.
" corner Erin St.
" Tuomey Town.
" corner Second St.
" corner Fourth St.
" corner Fifth St.
" corner Sixth St.,
" corner Seventh St.
" near Eighth St.
" between Ninth and Tenth Sts.
" between Eleventh & Twelfth Sts
Prospect St., corner Tenth St.
Prospect St., corner Fifth St.
" corner Fourth St.
" corner Second St.
" between Second and Hickory Street.
" corner Hickory St
Providence St., opposite school house.
" between Roath and Hickory St.
" corner Hickory St.
" corner Pratt St.
" top of hill.
" above Tenth St.
" opposite Twelfth St.
" north of Twelfth St.
Fourth St., top of hill.
" near Chelsea office.
Fifth St., at canal.
" top of hill.
Sixth St., near corner High St.
" top of hill.
" near Gilmour's foundry.
Seventh St., opposite J. Enright's.
Tenth St., corner Providence St.
Twelfth St., corner Prospect St.

LAUREL HILL.

Laurel Hill Av., corner Summer St.. and in front U. S. Gardner's.
" near cor. Winchester St.
" in front Dr. Baker's.
" near corner Walnut St.
Summer St., opposite J. C. Perkins'.
" opposite N. Standish's barn.
Winchester St., in front G. B. Brigden's.
Walnut St., near J. D. Park's.

SERVICE PIPES.

There have been laid during the past year, 92 services of the following sizes and lengths:

740½	feet,	½	inch.
1005½	feet,	¾	inch.
48	feet,	1	inch.
37	feet,	2	inch.

1831 Cost, $846 98.

Average length, 20 feet. Average cost, $9 20.

Whole number services laid to March 31, 1879, 1,595.

Total length,	38,332 feet.	Total cost,	$19,144 90
Average length,	24 feet.	Average cost,	12 00

CONSUMERS.

For years ending March 31,	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879
Families..	370	607	804	1012	1162	1376	1446	1633	1784	1967
Offices and stores...........	77	126	153	189	229	259	275	282	305	418
Baths......................	62	113	133	162	187	216	244	266	300	345
Water closets.............	97	185	223	272	374	437	529	621	688	754
Urinals....................	22	21	35	35	49	59	67	68	73	76
Photographers.............	2	5	5	6	7	7	7	8	6	5
Printing offices.............	3	4	3	3	3	3	3	3	3	2
Saloons.......	15	21	26	22	23	25	26	33	34	35
Markets....................	4	11	11	13	18	17	25	29	32	33
Manufactories..............	10	20	21	28	33	35	43	54	54	57
Livery and private stables	38	70	85	107	117	130	141	164	184	187
Horses and cows..	146	272	316	311	336	482	529	594	612	630
Street front sprinklers	30	67	96	128	196	235	181	222	228	239
Lineal feet			6992					12,785	13,225	13,528
Gard'n hydrants and hose	11	50	83	110	179	188	209	267	289	307
Square feet			516,800					1,800 000	1,895,000	1,954,000
Private fire plugs...........	28	38	25	29	31	37	49	48	46	38
Green houses and graperies	2	6	5	6	6	6	9	7	7	6
Jet and spray fountains.....	2	6	8	8	7	8	10	12	12	13
Steam engines............	7	18	17	21	26	25	24	29	31	29
Public and private schools..	7	7	8	8	10	10	11	11	13	13
Fire engine houses.........	6	6	6	7	8	8	8	9	9	9
Public fire cisterns.........	20	20	20	20	20	18	18	18	18	18
Public water troughs.......	2	4	4	4	4	4	4	5	6	7
Steamboats.................	1	2	4	8	8	8	8	6	4	5
Railroad co.................	1	1	1	1	1	1	1	1	1	1
Not classified..............	7	7	18	21	26	33	24	24	29	33
Public fire hydrants........	84	88	108	115	143	170	224	232	238	241
Annual rates ....$	5,918.04	9,713.80	11,882.75	14,130.49	16,376.17	17,790.44	19,251.46	21,024.58	22,067.30	23,344.54

Whole number of applicants to March 31, 1879, . - - - - - - - - 2,744.

This statement includes Greeneville and Laurel Hill.

We are supplying in GREENEVILLE:

	March 31, 1877.	March 31, 1878.	March 31, 1879.
Families,	73	177	245
Stores,	3	11	11
Baths,	8	13	16
Water closets,	6	15	15
Saloons,	2	4	2
Markets,	2	4	3
Manufactories,	4	4	5
Livery and private stables,	13	16	17
Horses and cows,	51	59	56
Public schools,	2	2	2
Garden hose and street sprinklers,	23	41	49
Private fire hydrant,	1	1	1
Steam heater,	1	1	2
Steam engine,	1	2	3
Fire engine company,	1	1	1

Annual rates, March 31, 1877,	$818 20
" " 1878,	1,600 20
" " 1879,	1,988 44

LAUREL HILL.

	March 31, 1877.	March 31, 1878.	March 31, 1879.
Families,	40	45	55
Baths,	13	19	22
Water closets,	17	19	27
Private stables,	5	5	4
Horses and cows,	14	15	13
Garden hose,	9	13	20

Annual rates, March 31, 1877,	$362 50
" " 1878,	422 00
" " 1879,	517 00

CONSTRUCTION ACCOUNT.

Total cost of Works to March 31, 1878, $387,703 11.

EXPENDITURES FOR THE YEAR ENDING MARCH 31, 1879.

Pipes, gates, hydrants and appendages,		$1,452 63	
Freight and cartage,		73 38	
Tools and material,		15 04	
Pipes and fittings for services,	$645 67		
Labor, making and laying services,	427 00	$1,072 67	
Transferred from income account,			$2,613 72

RECEIPTS.

April,	Cash from Income,	$137 25	
	" City Treasurer.	35 38	
May	" Income,	178 75	
June.	" "	80 12	
July,	" "	33 00	
August,	" "	57 67	
September,	" "	96 12	
	" City Treasurer,	506 57	
October,	" Income,	73 97	
	" City Treasurer,	317 65	
November,	" Income,	49 15	
	" City Treasurer,	127 98	
December,	" Income,	133 29	
	" City Treasurer,	156 13	
March,	" Income,	233 35	
	" City Treasurer,	397 34	$2,613 72

Total cost of Works to March 31, 1879, $390,316 83.

INCOME ACCOUNT.

EXPENDITURES.

For Pipes and fittings for services,	$645 67	
" Labor, making and laying service pipes,	427 00	$1,072 67
The above items are transferred to construction account March 31, 1879.		
" Labor and material, roads, walls and water courses at Reservoir,	$35 50	
" Labor and material, valve outside of well-house,	237 37	$272 87
" Labor and material for, and re-paid by consumers,		256 99
" Injuries to property,		189 50
" General maintenance,		4,572 57
		$6,364 60
Cash balance to the City Treasurer,		16,623 06
		$22,987 66

RECEIPTS.

From regular water rates,	$21,948 22	
" Delinquents' 5 per cent.,	57 89	
" Sale of water,	317 79	
" Builders' use,	406 77	
" Labor and material furnished,	256 99	$22,987 66

There is due at this date:

For Hay, &c., sold from Reservoir,	$50 00	
" Labor and material,	26 55	$76 55
Uncollected water rates,		none.
Total expenditures for all purposes for the year,		$7,905 65

A very large number of our citizens' houses, stores, offices, and manufactories depend wholly upon our Works for water. The stopping of supply from some of our manufacturers, for even a single day, would cause great loss and inconvenience. We have but one main from Fair View Reservoir to Williams Park. Should any accident occur to this, necessitating shutting off supply to the City, you can readily see the serious position in which the City would be placed; and not only this danger, but it is found by experiment that the capacity of our present main is not great enough to give effective head for fires at Greeneville and West-Side at the same time. Our excellent fire department depend entirely upon hydrants for extinguishment of fires. They approach a hydrant, confident it will respond promptly to them; should the supply cease from failure of the main or other causes, recourse must be had to the river with steamers, which for a large part of our City could accomplish but very little. After long deliberation upon this matter, I have prepared estimates for a second main from Fair View Reservoir to the upper end of Williams Park. The cost of this main, with all necessary connections, gates, blow-offs, and also all land damages, will be $19,500 00.

I trust this may meet your approval, and that you will recommend to the City Government, that an appropriation be made for this purpose.

Respectfully submitted,

H. B. WINSHIP,
Superintendent.

At a meeting of the Court of Common Council, held May 21, 1879, it was

Resolved, That the report presented by the Board of Water Commissioners be, and is accepted, and referred back to the said Board of Water Commissioners, with the direction to have one thousand copies printed.

Attest — CHAS. W. GALE,
City Clerk.

The following resolution was adopted :

Resolved, That the vote of the Board of Water Commissioners, requesting an appropriation of $19,500 00 for a second main from the Reservoir to the north end of Williams Park be accepted and approved ; that the Clerk cause the same to be published as required by the amended charter, and that the Mayor, or in his absence the Senior Alderman present be directed, in behalf of this Board, to submit the estimates, as embraced in their report, to the next City meeting, to be held on the first Monday of June next, and to recommend the amount therein named.

Attest— CHAS. W. GALE,
City Clerk.

That portion of the Water Commissioners' report relating to the use of hydrants for fire purposes, was referred to the Finance Committee.